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THE USE OF SEAPLANES IN FOREST MAPPING

BY ELLWOOD WILSON

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In 1905, when confronted by the problem of making a map and estimate of 2,500 square miles of timber limits in Quebec, the writer looked into the possibility of using captive balloons, and found that the cost of transporting materials and equipment into the woods and the limited range of country which could be photographed from one ascension would make this impracticable. With the introduction of airplanes hope of using them sprang up, and in 1915 an aviator was practically engaged, but no machine could be obtained for the amount of money available. In December of 1918, the idea again came up and the Hon. Jules Allard, at that time Minister of Lands and Forests of Quebec, promised his support in making an experiment, and offered a subsidy of \$2,000 toward it. The St. Maurice Forest Protective Association, interested from the standpoint of discovering fires, voted \$10,000. It was learned that the United States Navy had turned over to the Department of Naval Affairs of the Dominion Government ten or twelve seaplanes which had been used in a joint patrol and which it was learned would not be used by this department. Application was made to the Hon. C. C. Ballantyne, Minister of Marine and Fisheries, for the loan of two of these machines, the request being seconded by the Aerial League of Canada and the Canadian Forestry Association. The Minister kindly consented to loan two machines, and on the 5th of June, one was flown to the base near Grand Mère. The pilot, Lt. Stuart Graham, R. N. A. S., immediately returned to Halifax and flew the second machine up, arriving the 23d of June. Seventy-eight per cent of the fires for the season had occurred by this date so that the usefulness of this method of spotting fires could hardly get a fair trial this season. Only four fires which required other labor than that of patrolmen to extinguish occurred after this date and one of these was

discovered and reported by the plane. Two other fires which were of no consequence, one being on a farm outside of the patrol area, were discovered and the machine flown over them to ascertain what they were and whether they were worth reporting. Fires can be distinguished at forty miles, and a safe estimate of the area of visibility is within a radius of twenty miles. In times of forest fires either within or without the patrol area when the smoke is very heavy, flying is out of the question, so that it will eventually be necessary to have very large areas under intensive protection methods in order to eliminate smoke as far as possible.

It was found that a Johnson fire pump and 1,500 feet of 1½-inch hose could be easily transported anywhere within a radius of 150 miles within 2¼ hours. This would mean that the equipment could practically always be landed within two or at most three miles from the scene of any fire occurring in the district patrolled. The writer made many flights and sighted one fire and knows whereof he speaks.

The machines used were Curtiss seaplanes, type HS2L, with 330-hp. Liberty motors, and arranged to seat three people. The machines weigh about 3½ tons and are remarkably sturdy and steady in the air. A forced landing, owing to an accidental cut in the insulation of the ignition wiring through which water entered making a short circuit and stopping the engine, was made on land, so gently that the occupants of the machine hardly felt it touch the ground and without other damage to the machine than the breaking of the lower wing floats due to the rocking after landing.

This type of machine requires a mechanic as well as a pilot to operate the valves from the reserve gasoline tanks and to maintain an even feed of fuel. The observer sits in a cockpit in the front and has an ideal opportunity to see the country, to take photographs and to make sketches and notes. All this can be done easily and comfortably on a small drawing board held on the knees. Altimeter and compass are within easy view.

Owing to the impossibility of making artificial landing fields and the absence of natural ones, the airplane is entirely out of the question for use in Eastern Canada, but the great number of lakes, 6 per cent of the total area, makes the seaplane the ideal machine. The only drawback to the use of the HS2L type is the expense of the fuel, 27.6 U. S. gallons of gasoline and 1.8 gallons U. S. of oil per hour being required. On the other hand the advantages are, sturdiness, stability, even in very high winds and on "bumpy" days, safety of personnel, wide cruising radius, and the ability to maintain a uniform altitude and fly

on even keel, the latter qualities being very useful for photography. The ideal equipment for forestry work over large areas would be two light machines for patrol and one HS2L for taking help to fires and for photography and reconnaissance. For a machine for all purposes one of about half the weight of the HS2L, with two engines and extra gas tanks might be the best. The two machines flew 6,000 miles during the season, 1,500 to get them on the job and 4,500 in patrol, reconnaissance, and photographic mapping.

It may interest the profession to give a brief description of how our forests look from the air, and what can be seen by a flier. The forests of the St. Maurice Valley are mainly of the hardwood-softwood or softwood-hardwood type, with some areas of softwood, spruce, and fir alone, and of pure jack pine. There are black spruce swamps, swamps without tree growth, burns, some of which are restocking, and lumbered areas. With the exception of the lumbered areas, all these types can be easily distinguished from the air and the lines of demarcation can be seen and sketched in with an accuracy and ease absolutely unattainable on the ground. It is, as every forester knows, often extremely difficult to say where one type leaves off and another begins, but this is not the case from the air. For rapid reconnaissance work, the best map available of a country can be taken into the air and the types sketched on, using lakes or other prominent features as units of measurements for areas, that is, a certain type may be as wide as a certain lake and five times its width in length.

In regard to distinguishing different species from the air, pine can times spruce can be differentiated from balsam by the difference in color, the black spruce of the swamps is readily recognizable. Pure jack pine stands have a distinct color and appearance. Birch can be distinguished from poplar, elms are readily recognized, as are maples. Of course when the leaves are turning in the autumn the recognition of different species is very easy, and the tamaracs are noticeable. After the leaves are off the white birches are quite distinct from the other hardwoods, and the maples and beeches show up distinctly.

The boundaries of burns are easily seen and where reproduction has commenced the amount and approximate height can be easily estimated, even when it is coming up under a thin stand of poplar and white birch. One can tell whether the young trees are three feet or six feet high.

From my experience I should say that a forester could get a better idea of fifty square miles of unknown territory in two hours' flying than he could after two weeks spent on the ground. Let me warn my

readers that they must not be too skeptical about the results which can be obtained as I have seen many preconceived ideas completely changed after short flights over forest areas. Until one has flown he can have absolutely no idea of how much can be seen from the air, especially after a few flights. It is exactly like having a colored relief map spread out below one for study.

Owing to a strike of lens makers it was impossible to procure an aerial camera until the season was almost over but many trials were made with various hand cameras and some good oblique pictures obtained. An aerial plate camera of the type used in training cadets, using 4 by 5 plates, hand operated, was tried and good pictures obtained. It was found very hard to get these to overlap and the capacity of the camera was small, as was the amount of country covered by one exposure. Finally a K1 Eastman Aerial Camera was obtained, operated by a wind motor and taking 100 pictures 7 by 8½ automatically and continuously. Nearly four hundred of these were taken over all kinds of country with most satisfactory results. This camera was found most satisfactory, easily regulated as to speed, very simple to load and operate and with very little to get out of order. It is made with lenses and cones which can be interchanged in a moment; so that, if wanted, pictures can be taken at a good altitude covering a large amount of territory, which can be used as controls, the lens can then be changed and the details filled in from a lower altitude.

Pictures were taken from 1,000 to 5,200 feet altitude and the best results for all round work over forests were obtained at about 5,000 feet which gives a scale of approximately 400 feet to one inch. No difficulty was found in keeping the elevation of the plane sufficiently constant to avoid changes in the scale and the pictures could readily be matched up and checked well with the maps where the latter were available. There is almost always some land feature which shows in a strip of pictures the length of which is known or can be measured, by which to check the scale.

As to what can be read from the photographs. We are still in the very infancy of this work, but it may be said without question that for mapping purposes alone, the photographs are far superior both in detail and accuracy to ground work. The speed of operation is also far superior. On the ground, in this country, with a party of ten men using the plane table, 50 square miles a month is the average area covered, as against 200 square miles per day with good photographic weather, which can and has been done easily.

As to making estimates of timber from photographs, it is possible for pure softwood stands. For mixed stands it is still out of the question in the present state of our knowledge. I think, however, that as we proceed with our studies we shall be able to do something along these lines. Lakes, rivers, and creeks can be seen and measured accurately, even where creeks are partly hidden by trees their courses may be followed. Roads, trails, and portages where not too overshadowed can be traced. Camps, dams, booms, and depots show up well. Logs in rivers show up well and photographic reports of the progress of drives will be of value. Swamps, burns, and pure softwood stands can be seen and delimited easily, in open country the character of the soil is shown by the light color of the sand. Rock out-crops where burns are deep show up with startling clearness. One can see whether burns are reproducing or not and can tell the kind of reproduction, whether hardwood or softwood. Under our conditions, it cannot be told whether a hardwood-softwood stand has been lumbered or not, except that camps and roads can be seen. No estimate can be made of the proportions of species in mixed stands from photos. The index of reflection for softwood is so nearly that of the ground sometimes that we cannot be sure whether dark spots in mixed stands are holes or softwoods.

In order to read the photos, experiments are being made. Areas which appear typical on photos are being carefully cruised on the ground to see if they can be used as standards in reading. Oblique photos promise some help. "Close ups" taken at 500 to 1,000 feet may help. Panchromatic films and films sensitive to different colors will be tried, with and without light filters. Much has already been accomplished by an intensive study of photos on the ground. It is hoped that shortly a technique of interpretation can be worked out similar to that used in reading military photos.

The writer feels that aerial work is destined to play a large and important role in the work of the forester, particularly in inaccessible and unmapped country and in making the progress reports which are so necessary. It will eliminate an immense amount of drudgery and allow of rapid and relatively accurate reconnaissance work which has been entirely out of the question in the past, as for instance the reconnaissance of whole states, provinces or regions which would in the ordinary course take years to accomplish and whose cost would be prohibitive.

In regard to the cost of the work. It is probable, basing the prediction on actual work done, that complete photographic maps may be turned out at not to exceed \$25 per square mile. The areas in timber can be marked off and ground estimates made.

LEGISLATIVE MACHINERY FOR ENFORCEMENT OF PRIVATE FORESTRY MEASURES¹

BY C. R. PETTIS

Superintendent of State Forests of New York

In the discussion which has taken place in this summer's meeting of the New York State Section of the Society of American Foresters, I think that our discussion has been narrowed down, in some respects, too much to a consideration of the problems presented here in the Adirondacks. Furthermore, I feel that forestry can be practiced with greater profit and ease in a large portion of the forest regions outside of the Adirondacks than it can within the territory; therefore, that a consideration of the problem should be State-wide rather than local. There are, however, phases of the discussion which have taken place which, even though applied to a limited area, should not be passed over without comment. There is a particular type of land in the Adirondacks which deserves particular consideration, namely, the pure spruce type on the mountain tops, which, if lumbered and practically kept clean, leave very heavy slash and enormous fire risk, and, if burned, all of the soil is destroyed and only the bare granite rocks remain. In my judgment, this land should not be lumbered out; on the other hand, should be acquired by the State and classified as a protective forest region.

Observations covering the land all lying at lower altitudes show that it may be classed as hardwood type. This type can be lumbered and still remain productive, in my judgment, if certain provisions are complied with. It will, however, reduce the forest cover and create a very heavy fire risk, but, on the other hand, will afford merchantable material, and, if fires can be eliminated, will not be withdrawn from production. There are certain qualifications as follows in regard to this matter:

1. That the size of the area to be lumbered must be limited and that these areas should not be contiguous, but should be broken by bands of green timber. This, of course, will increase the lumbering expense, and there are points in connection with the operation which

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

would have to be carefully worked out, but the idea is that prevention must be practiced in the lumbering, in order to handle the fire situation.

2. I believe that an attempt should be made to make the forests which are lumbered more fire proof. We are willing to co-operate in studies of hardwood slash disposal, in order to ascertain the expediency, costs, benefits, length of time of the fire risks, etc., and these provisions are to be applied.

3. Whenever lumbering operations take place, the resultant is an increased forest fire risk. One owner may lumber his property, while the adjacent owner may not cut. On account of the operations conducted, the value of the adjacent unlumbered land has been reduced on account of the increased forest fire risk. It would, therefore, seem on account of an operator causing a fire risk and hazard, which must be classed as a nuisance, that there should be some burden imposed upon him in connection therewith. Quite likely an operator should pay a cutting tax and this money should be used to build fire lines or the employment of additional patrolmen, sub-observation stations or some other fire preventive or protective measure and the money to be expended on the area where the timber is cut.

4. Fire lines should be left around the operations. No slash should be left within at least 50 feet of the lands of the adjacent owner, nor in the parcels described in No. 1 above, nor should slash be left within 50 feet of the edge of the cutting.

5. It would be very desirable, although there is some question as to how it can be worked out legally, to provide that there be left strips of uncut timber along highways, railroads, rivers, lakes, etc., and that no softwood be cut within a short distance and hardwood within a wider strip. I believe the lumbermen could well afford to leave this material, as it would screen their cutting; make a fire line; not attract attention to the removal of the forest cover, and thus save public criticism of their work.

The above applies to lands upon which operations are to be conducted, but there are other classes which are now lying unproductive and I believe owners should be required to reforest their land with suitable trees, provided they are furnished free of cost at the nursery.

There has been so much discussion in the past in regard to silvicultural management of the forests and to the younger men the question as to what to do is sometimes uncertain. We simply have to look back to the practice of Pinchot and Graves at Nehasane and compare

that with the practice inaugurated by Fernow at Axton. It is my belief that funds should be provided for thorough investigation into silvicultural methods and that this work should be carried on by the State forest schools.

I believe that provision should be made for suitable demonstration areas in regard to handling forest and farm wood lots through the State, and this work can best be carried on in co-operation with the farm bureau agents.

It is my firm belief that the State should make a suitable appropriation for the employment of ten competent foresters to work through the State upon the line of the farm bureau agents, and these men could study the conditions, give advice, and work on marketing problems and other matters of this kind.

ONE ASPECT OF THE NATIONAL PROGRAM OF FORESTRY: COST¹

BY RALPH S. HOSMER

Professor of Forestry, Cornell University

The critical point about which the national program of forestry centers is cost. From whatever angle one approaches the subject he comes to it. In every solution proposed it is the element most to be reckoned with. I desire briefly to discuss this aspect of the case, together with a correlary that naturally proceeds from it.

Colonel Graves has forcibly reminded us that as a nation we are rapidly approaching the time when our timber supply must come from second growth. To provide adequately for the future we cannot leave the production of forests to chance. Systematic forest regeneration must succeed exploitation of stands that we have found ready to harvest. But it takes a long time, and usually an outlay of money, to produce forests. The question that presses for solution is: Who shall bear the cost and how shall the necessary funds be provided?

We all admit frankly that serious mistakes have been made in the past in the handling of the forest areas of this country. We have been recklessly extravagant and have acted without thought of the future. Had the forested portions of the public domain been retained by the nation the evil day that is now upon us might have been averted. But those mistakes are of the past. It is our duty today to get out of the muddle as best we can.

There seem to be three courses open, for securing a permanent timber supply for the future: (1) To make this generation stand the cost, through what has been termed the "replacement idea;" namely, the speedy reestablishment of forests through natural or artificial means. In this case the bill is paid by the consumer of this generation, either directly or through taxation. (2) To spread the cost out over a longer period, by means of government loans or bond issues that shall provide the working capital to establish forests, the yield from which shall at least in part pay off the bonds at maturity. This

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

has been called the "investment idea." Under it the price of future forest produce will be based upon and will include the cost of raising the timber.² (3) The third method, which may be called the "*laisser faire* idea," is to leave things more or less to take care of themselves, in the hope that with altered economic conditions in the future the second growth that results after present day lumbering will be sufficient to serve our needs.

Obviously the first point to be settled is which of these three methods we are to adopt, for on the choice that is made hang all the plans of management that we are now so busily devising. This choice must be made by the people of this country, for it is they, ultimately, whatever happens, who will have to pay the bill. So far in the discussions of this question this point seems to have been overlooked or minimized. It seems to me of fundamental importance, for until the decision is made we are at a loss how to proceed as to details.

To be able to make a wise selection the public ought to be made to understand clearly what the result will be of diminishing our forest supply, without provision for the future. Already we are beginning to feel the pinch, but as yet few persons realize the economic cause for it. It is true that it is hard to interest the public in what seems a remote contingency, but I believe there is need of pressing home this point in a frank and fearless manner. We foresters should not be afraid to say that forestry methods *do* cost more than the exploitation of original stands, but also we can and should show that without forestry the prices of wood materials are likely to go much above what they will be if systematic forest management is undertaken without more delay. As a nation we have had our cake and eaten it. It remains to be seen of what we will make our next meal.

Of the three courses open to us the third, the "*laisser faire* idea" will, I think, meet with little favor among foresters. Even though we still lack many data that we ought to possess, we do know that, taken by and large, the second growth that follows indiscriminate logging is but a poor reed on which to lean. Further, even were the outlook good, as of course it is in a few rather local regions, there is the period of adjustment to be considered, with its train of consequences which Professor Chandler outlines in the paper he reads today.

The choice then, if it is to be a wise one, seems to lie between the "replacement" and the "investment" proposals, or what is more likely, in a plan that borrows from each. Whichever of these plans is finally

² A National Forest and Lumber Policy. By B. A. Chandler, *American Lumberman*, July 5, 1919, p. 1.

adopted, the initial burden of producing future forest crops must be borne in one of the three ways: (1) By the present forest owner; (2) by the public; or (3) by the forest-owning interests sharing the bill with the general public. The last seems the reasonable solution and is in effect that proposed by Colonel Graves. But in what proportion shall the division be made, and how, and when? Here again the part that the public is to play seems to have been taken for granted; but is this safe assumption? No such program as is proposed, whether it be ameliorative, "impulsive," or mandatory can be put into effect without there is strong public sentiment behind it, and no policy can endure unless it rests on a sound economic basis.

Methods must of course be worked out, and it is our particular duty as foresters to develop them, but in getting the program started and under way too great stress ought not to be laid on parts of the project that necessarily must be developed gradually. My personal feeling is that mandatory measures should be approached with caution and that we have not yet exhausted all the other means that should precede them. What, it seems to me, is needed now is to get united support behind the comparatively few things on which there is substantial agreement among all concerned and in favor of which a public sentiment already exists. Almost every one connected in any way with forests is now in favor of fire protection. Few are opposed, except as it entails expense, to the principle of public ownership of forests. Many are at least open to conviction on the subject of forest tax reform. These, with ameliorative measures like extension work in forestry through Federal aid, or by the States in the way of making forest planting easier, can all command public support at the present time. If such measures were actually and fully put into effect we should have gone a long way on the road we are traveling.

The advantage of getting these things going is two-fold. Not only are they beneficial in themselves, but naturally and readily they lead into further development. Here in the Northeast were conditions bettered only a little, the outlook for the practice of forestry by private owners would be markedly changed. The next steps might well be an extension of Government credit to owners of forest land, similar in principle to the farm loans, or a Government bond issue for the benefit of the forests, or even insurance by the States of standing timber against fire. These things are all in the way of taking care of the cost by the public, and especially of bridging over the gap until forests under management become revenue producing. But in getting them under way it should also be made clear that they are only a part

of the things that need to be done and that the program as a whole must go farther.

Now all such measures require the backing of public opinion to be put in force. To develop such a sentiment is of course one of the objects of the present nation-wide discussions of this forestry program. But is there not danger that the whole program may be slowed up, if indeed not brought near shipwreck, if these discussions center wholly on methods and details, and particularly on those having to do with regulatory and mandatory measures? It is not difficult to antagonize the people to whom we are making our appeal. If these discussions lead to a break between lumbermen and foresters there is, to my mind, little hope that there can be secured the public sentiment that is essential for successful accomplishment. Certainly fault-finding and recrimination do no good, whether indulged in by lumbermen or by foresters.

Foresters of this country have no monopoly on desiring to do what is best for the nation in the long run, although we like to think that in this regard we are in the lead. There are many more of like mind, including not a few lumbermen. Is it not therefore good sense to proceed somewhat slowly in this business, by first getting together on the things about which we can all agree, and by working hard to get them started?

The policy as a whole to succeed must be absolutely sound from an economic standpoint. It takes time to formulate such a policy. But while the more difficult portions remain under discussion there is no good reason why we should not begin with fire protection and public ownership and the other things on which we can all unite now. I believe this to be the rational method of procedure and that if it is followed at least a part of the problem of cost will take care of itself.

FUNDAMENTAL SILVICULTURAL MEASURES NECESSARY TO INSURE FOREST LANDS REMAINING REASONABLY PRODUCTIVE AFTER LOGGING¹

BY HUGH P. BAKER AND EDWARD F. MCCARTHY

Not since the first efforts to define a silvicultural practice for the forests of North America were begun by Dr. Fernow, Professor Roth, Colonel Graves, and others, has the question as to what is good silvicultural practice for our eastern forests been as important as it is in these days of reconstruction. The leading lumber and forestry journals of yesterday and today tell us of the cutting of the southern pine forests at the rate of 50,000 acres per day, of efforts being made by the lumber industry of the country to take care of increased production by seeking a foreign market, of great fires in the Northwest destroying valuable timberlands over extensive areas, and over against these things and much nearer home to us is the rapid increase in the cost of production and market price of practically every product of the forest. Just behind these conditions of today is the evidence of the value of forests in a national crisis. Can we doubt that the forests of France, of the United States, and even of England and Spain, were vital factors in the winning of the war by the associated governments? The place the forests of the world played in the Great War and the vital need of forests and forestry in the industries and in the life of the nation are responsible for the agitation started by the United States Forest Service for more definite forest policies and especially for right policies in the development of private forestry.

In the literature put out by the U. S. Forest Service in which it seeks the interest and assistance of all interested in the forests that we may have a sound forest policy for the future in this country, the basic statement made is that it is obligatory upon the timberland owner as well as the State and Nation to see that forest lands are kept in a productive condition. It will be unfortunate if in the propaganda carried on for the development of private forestry, right methods of

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

making forest land productive are not given greater consideration than is being given today. One fault all down through the development of forestry in this country so far has been too great indefiniteness too few facts as to how to make forest lands productive and what may be expected of efforts toward productiveness. Twenty years ago we talked of clear-cutting and planting in the eastern forests, ten years ago we were confident that the selection system applied on the basis of a diameter limit was the right practice, today we may be back again where we were twenty years ago in our ideas of what is right silvicultural practice for the Adirondack forests.

The lumberman who has cut with immediate and satisfactory financial return constantly in view has with very rare exceptions had no idea of any practice except to clear cut and abandon the land to those who might care to follow. In this statement we do not condemn the lumberman of yesterday because we know that he represented a period in the development of the Nation. The miner who left many thousands of tons of coal in the ground because it was a bit inaccessible, or the farmer who mined the fertility from his farm in the Eastern States and moved westward to richer lands, are in the same class with the lumberman who cuts with no thought except immediate profit and no idea of responsibility to his neighbor and to his State.

The foresters of this country during the past decade and more have been somewhat at fault in their attempt to introduce silvicultural methods into the cutting of the forest and into the treatment of cut-over lands. We have been too definite, we have lacked facts, we have not been able to tell the lumberman exactly what might happen under his particular conditions or that he should use a certain method of cutting or should treat his cut-over lands in a certain way. Coupled with our indefiniteness we have been afraid in many instances to give reasons for the faith that is in us. Sometimes it was fear of organizations or groups of men who are interested in recreation only in the forest; sometimes it was fear that if such facts as we have were told the public without their proper education in the handling of the forest that they might not agree and might cut off support for the work being done. The time is now at hand when we shall go back as a profession and as individuals in the profession if we cannot stand aggressively for the securing of the facts we need and their proper presentation to those concerned.

It is with the idea that a discussion of the silvicultural treatment of cut-over lands involving as it will a comparing of the experience and knowledge of the individuals making up this gathering, that the

following preliminary statements are presented for consideration. The facts presented were secured as the result of some seven years of observation and study largely in the Western Adirondacks. It is not assumed that a silvicultural treatment that will be satisfactory for the Western Adirondacks would apply equally to the Eastern Adirondacks or to New England.

SOFTWOODS VS. HARDWOODS IN THE ADIRONDACKS.

As a basis for discussion may we agree that the purpose of forest management in the Adirondacks for the next 100 years is the production of the largest amount of softwood consistent with sound financial development. The production of good hardwoods over a major portion of the Western Adirondacks is simple, requiring heavy cutting and fire protection only. When an attempt is made to convert the stand into softwood, the problem becomes complex. The continuous logging of softwoods for lumber and pulp without destroying the hardwood crown has in the main converted the forest to hardwoods rather than producing the desired softwoods. It is well understood among us that the hardwoods have remained in the forest because of cost of transportation and lack of market accompanied by ever increasing value of softwoods for pulp. No one can say what will be the ultimate hardwood market. Hardwood lands throughout most of the United States were largely of agricultural value and are now converted either into farms or remain as farm woodlots which at this time give only small promise of entering into large competition in the lumber market. It is neither sound financially nor sound from a forestry standpoint, therefore, for us to attempt to rid ourselves completely of the hardwood forest which comes so easily and with so little expense in the major type of this region. We will attempt to show in this article that complete conversion to softwood can be accomplished only after several rotations and that only by persistent effort or through large initial expense.

VALUES OF THE FOREST, OTHER THAN WOOD PRODUCTION, WHICH WILL BE EFFECTED BY THE PRACTICE OF SILVICULTURE.

From the standpoint of soil protection and water storage there is a very inconsiderable portion of this region represented by thin soil on the ridges which will suffer from close cutting, providing, of course, that fire be kept from the ridges. Even thin soils on level or medium slopes acquire a protective covering of brush and herbaceous vegeta-

tion so quickly after cutting that the humus will not disintegrate with the result that the soil value of the site is not lessened to any marked degree. Hardwood saplings soon restore the shade needed for water retention. Ten or twelve years is usually enough where fire is kept out to develop a vegetation, providing there is shade so dense that moisture conditions will approach if not exceed those of the area before it was logged.

Those whose chief interests in the forest are the wild life and recreational value, and there are many such in the State, can find little basis for the thought that logging is adverse to the propagation of wild life. Those familiar with the habits of deer recognize quickly that winter feed is after all the limiting factor in their propagation. The virgin forest gives protection to the deer yet lacks the amount of young growth which results from a regulated cutting. Beaver find the best habitat in the second growth that follows a logging operation; small game generally propagates more rapidly in the disturbed habitat of the cut-over land. No forest land can at the same time retain the characteristics of virgin wilderness, yield the maximum amount of lumber, and serve as the most desirable home for game. Experience in the forest areas of Europe show that a properly managed and a properly protected forest is vastly superior to a virgin forest, both in the way of production of timber and in the production of game. Unceasing efforts must be made in the way of education before the owners of our State lands—the people—can be brought to appreciate sound forest management. We must ally ourselves with those interests concerned primarily with the wild life of the forest and this can be accomplished by education and by compromise. Any lengthy discussion of this subject is out of place in this paper.

THE FOUNDATIONS OF SILVICULTURE IN THE ADIRONDACKS.

No plan of silvicultural management can be applied to the Adirondack forest which does not recognize and define clearly forest conditions and types now in existence. The ultimate care of the forest must recognize details which are much too numerous for discussion in a brief paper of this kind.

No attempt will be made to enlarge upon or change either in definition or nomenclature the four main types now recognized, namely, swamp, spruce, flat, hardwood, and upper slope.

The boundary line between the spruce flat and hardwood type is most confusing and needs discussion. In point of topography the

term "spruce flat" is a misnomer since the association of species in this type in certain parts of the Adirondacks covers the slopes and tops of ridges often well drained and of an elevation of 100 or more feet. This type often carries with it also a deep humus covering of the soil. Commonly the type includes knolls and narrow ridges which are covered deep enough with humus to prevent the entrance of hardwoods.

The lower areas of the hardwood type varies enough to warrant division into a group of its own and this especially from the standpoint of reproduction. This portion of the hardwood type because of topography or water seepage has a moister soil with resultant increased percentage of soft maple and yellow birch. Softwoods also reproduce better and compete more effectively in growth. The upper part of this type differs in having a greater percentage of hard maple and beech. Table 1 accompanying this paper shows this characteristic persistence of the hardwoods in reproduction.

HISTORICAL FACTORS AS INFLUENCING PRESENT TYPES AND FUTURE TREATMENT.

The type historically intermediate between that following fire and the stabilized association may be defined or interpreted by three species of trees now found in mature stands. These three, the white pine, the yellow birch, and the black cherry are especially prominent because of ability to make rapid growth in their early life and because they must find places in the upper crown cover or perish under the shade of the more tolerant species. Pine has very small representation in the cut and burned lands of the Western Adirondacks because seed trees are lacking. Black cherry is more plentiful in the cut and burned land than it was in the original forest, while yellow birch is playing a very prominent part in the recovery of all clear-cut lands whether burned or not.

The difference in treatment of various areas where fire has been kept out will affect reproduction according to the extent of the destruction of crown cover and to a lesser extent by the destruction of seed trees. While there are all gradations of forest removal in the Adirondacks from heavy cuttings followed by excessive fires to stands where pine only has been removed, it is within the past twenty years only that logging of hardwoods has opened up the forest enough to give an adequate idea of how the land will reclothe itself after severe cutting.

It should be pointed out here that the cutting of spruce to a diameter

limit as a phase of the selection system meets so nearly the requirements of the logger that the method has been applied widely on private holdings in the Adirondacks. The results obtained by such cuttings have been pointed out in several recent articles.²

DETAILED CONSIDERATION OF FOREST TYPES AND THEIR TREATMENT

Swamp. Cutting of balsam in swamps has been carried on for a comparatively few years. This is true also of small hemlock to be used for pulp. The earlier practice of cutting swamps to a diameter limit in keeping with the diameter limit method in spruce has been abandoned because of resultant windfall. Clear cutting of all merchantable material has replaced this method. It has been shown³ that such swamps will recover if all timber is removed down to 4 inches d.b.h. and will eventually produce a very good crop of pulp. Reproduction comes in without extra care and growth is rapid. Balsam dominates this type and makes a desirable species at least while the market for pulp remains. The only improvement required is the destruction of the hardwood culls which occupy needed space.

Spruce flat. This type contains a large percentage of birch and maple in mixture with spruce and balsam. Upon the removal of the softwoods, the hardwoods persist and soon close openings in the crown cover. The removal of a portion of the hardwoods in connection with the softwoods will result in better reproduction and a quickened recovery of the advanced growth spruce and balsam. In any event, there will be a large amount of young hardwood started which will dominate the spruce and some of the balsam and pine.

Hardwood. Spruce requires about three years following clear cutting before it shows accelerated growth. Trees severely suppressed and over 75 years of age recover more slowly or not at all. In view of this condition it is not surprising that progress is not apparent in diameter limit cuttings.

²(a) Silvical Systems in Spruce in Northern New Hampshire. Edward R. Linn, JOURNAL OF FORESTRY, Vol. 16, No. 8.

(b) Results of Cutting at Ne-ha-sa-ne Park in the Adirondacks. B. H. Chandler, JOURNAL OF FORESTRY, Vol. 17, No. 4.

(c) Observations on Unburned, Cut-over Lands. E. F. McCarthy, JOURNAL OF FORESTRY, Vol. 16, (1918); pp. 897-909.

(d) Logging to a Fixed Diameter Limit in the Adirondack Forest. Hugh P. Baker, Proceedings Empire State Forest Products Association, 1915.

³Production of Pulp on Balsam Lands by McCarthy and Hoyle. Paper, October 23, 1918.

The hardwood crown cover must be broken up to show acceleration of softwoods and insure a straight boled growth of hardwoods. Table 1 shows the result of such a cutting where all merchantable hardwood was removed but enough cover left remaining to protect the site from too severe drying out.

Such opening up of the crown results in severe mortality of the smaller trees in the old stand which on the whole is desirable from the standpoint of the future crop, especially where timber left is now merchantable.

Considerable variation will occur on different areas in the hardwood type due to variation in moisture content of soil, amount of humus, and character of the virgin stand. Some ridges upon which there were originally no softwoods will remain pure hardwood unless under-planted. Small areas of pure softwoods, where deep coniferous humus has formed, will recover with a certain amount of aspen and fire cherry to the immediate exclusion of other hardwoods. In such areas the percentage of softwoods will be high ultimately. Not only is the hardwood type the major type of the Adirondack region, but it also presents the most varied and difficult problems. Rapid replacement of the mature stand can be accomplished only by the breaking up of the crown cover. Cutting of hardwoods first has proved impracticable because of breakage and the mortality through exposure of the softwoods left standing. The problem seems to have resolved itself into a question of how much softwood and hardwood may be left without the serious crippling of the young growth and without financial loss. It must be recognized that not only should the old crown be removed, but that the second growth of hardwood must be thinned as early as practicable to secure the best growth of softwood. Yellow birch is important as a nurse crop since it competes less severely than beech and maple with an under-story of softwoods.

Upper-slope type. This type is not of great commercial importance and should be treated as a protective forest. As shallow soils belong to this type, cuttings must always be light or resulting windfall will destroy the stand and, therefore, its protective value.

BURNS

The presence of considerable areas of burns gives planting a large promise of success if it follows a fire quickly so that the trees will get a start over the inevitable competition of native growth.

Intolerant softwoods can be used to good advantage. Plantations within 150 feet of hardwood stands will meet with more competition

from hardwood growth except in areas where the humus is deep and has dried out severely after the burning. Areas burned but once are recovering by growth of aspen which will have some commercial value and which later may be under-planted to advantage. Other hardwoods, especially yellow birch, will form a part of this stand, especially if the cutting preceded the fire by several years, so that saplings with ability to sprout were present.

SLASH DISPOSAL

The removal of hardwoods will result, of course, in a very large accumulation of slash, largely valueless at the present time. It is very desirable that the slash be disposed of both as a preventive of fire and in preparation for a new stand. Such facts as we have are not sufficient to justify us in saying that any one method of disposal is satisfactory today. Experimental work to determine right methods of disposal should be begun at once, especially in trying out the use of fire, which we understand is now being used experimentally in New Brunswick. Grazing should be given careful trial under different conditions in the Adirondacks, as, without doubt, it has considerable value in hardwood slash disposal.

A SURVEY OF FOREST LANDS, AND FORESTS NEEDED

Repeatedly, since the early development of the College of Forestry in 1912 it has been urged by the college that the State take stock of its forest land and forest resources.⁴ In this time of agitation for a forest policy for the Nation and the State, it is imperative that we know what we have as essential forest land. Studies should be planned and carried out in such a way as to prevent duplication of such efforts and arrangements should be made to publish results so that all may have the advantage of such data. Studies of soil, forests, and forest types must be carried out, based on sound silvicultural principles. Only after such studies have been made for New York can we formulate an effective forest policy. Such studies of forest lands and forests cannot be carried out along the lines of the soil surveys made by the United States Department of Agriculture. There must be injected into such studies the idea of sound economic practice. That is, a study of the chemical and physical properties of the soil only will not give the desired results.

⁴Logging to a Fixed Diameter Limit in the Adirondack Forest. Hugh P. Baker. Proceedings of the Empire State Forest Products Association, December, 1915.

TABLE 1.—*Number of trees per acre by species and diameter classes A (average of 12.2 acres actual caliper record) hardwood type, cut about 11 years previously for hard and soft wood, near Wanakena, in Southeast St. Lawrence County, N. Y.*

D. B. H. inches	Yellow birch	Spruce	Hard maple	Beech	Hem- lock	Balsam	Soft maple	Fire cherry	Black cherry	Aspen
1	14 ⁵ .9	23.6	111.4	92.3	.....	24.	128.4	196.	22.1	2.13
2	7.78	11.1	2.7	6.73	.....	.....	3.28	174.4	5.	.24
3	2.56	9.03	.738	6.9	.082	.082	.....	31.62	.24	.....
4	2.03	7.95	.41	4.75	.164	.082	.082	1.72	.....	.....
5	2.95	3.04	.24	2.05	.41	.....	.24	.....	.....	.....
6	1.38	3.12	.903	.....	.903	.....	.082	.082	.....	.....
7	7.38	1.72	.82	7.05	.903	.082	.164	.....	.....	.....
8	1.23	.903	.164	2.62	.49	.....	.082	.....	.....	.....
9	1.14	.24	.33	1.8	.903	.....	.41	.....	.....	.....
10	.738	.082	.49	1.31	.082	.....	.....	.....	.....	.....
11	.82	.082	.164	.98	.082	.082	.164	.....	.....	.....
12	.57	.....	.082	.57	.082	.....	.082	.....	.....	.....
13	.41	.....	.164	.49	.....	.....	.24	.....	.....	.....
14	.41	.....	.164	.74	.082	.....	.33	.....	.....	.....
15	.24	.....	.164	.33	.....	.....	.....	.....	.....	.....
16	.164	.....	.....	.082	.....	.....	.....	.....	.....	.....
17	.164	.....	.....	.24	.....	.....	.164	.....	.....	.....
18	.41	.....	.....	.082	.....	.....	.....	.....	.....	.....
19	.....	.....	.....	.082	.....	.....	.....	.....	.....	.....
20	.164	.....	.....	.....	.....	.....	.082	.....	.....	.....
21	.082	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.082	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.32	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	.24	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.082	.....	.....	.....	.....	.....	.....	.....	.....	.....
32	.164	.....	.....	.....	.....	.....	.....	.....	.....	.....
33	.082	.....	.....	.....	.....	.....	.....	.....	.....	.....
34	.082	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 2.—*Totals by zones on same area for two species only (average of 12 acres).*

	Lower		Middle		Upper	
	Birch	Hard maple	Birch	Hard maple	Birch	Hard maple
Average stand per acre	168.6	36.3	135.3	100.	100.9	338.7

SOME OF THE PROBLEMS

It will be seen from the preceding discussion that much more information is needed than is now available before it will be safe to formu-

late silvicultural plans with any promise of permanency. Some of these problems resulting from past treatment of the Adirondack forest which should be considered in working out a constructive silvicultural policy are:

- 1—Relative rate of growth of different hardwoods.
- 2—Determination of extent of mortality of various species following different degrees of removal of hardwoods.
- 3—Age or size at which spruce will make the quickest and most effective recovery when released from competition with hardwoods.
- 4—Results obtainable by under-planting.
- 5—Development of such a market for hardwoods as to justify their removal.
- 6—Brush disposal.
- 7—Soil factors in relation to seed germination.

INSPECTION, SUPERVISION, AND CONTROL OF PRIVATE FORESTRY MEASURES: METHODS AND COST ¹

BY A. B. RECKNAGEL

Forester and Secretary, Empire State Forest Products Association

The natural difficulties of this subject are increased by the fact that, when preparing this paper, I had no knowledge of just what private forestry measures Dean Baker would recommend in his opening paper.

I shall, therefore, confine myself to a rather brief presentation of the ownership conditions in the State, particularly in the two chief forested regions, the Adirondacks and the Catskills, and then consider what organization the State would need if each private owner of 500 or more acres of timberland were to operate under a working plan for continuous forest production.

We owe the figures on ownership, which I shall submit, to the timber census conducted by the War Committee of the Society of American Foresters, in co-operation with various agencies. This census shows that there are about 300 owners of over 500 contiguous acres of timberland in New York State. Of these we have more or less complete reports from 171 in the Adirondacks and 58 in the Catskills.² Besides this there are 52 reporting owners scattered through other regions of the State. Regarding size of holdings, the conditions are as follows:

Acres	Adirondacks		Catskills		Rest of State		Whole State	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
500-1,000	30	18	27	47	33	63	90	33
1,000-5,000	83	48	27	46	17	33	127	45
5,000-25,000	37	22	4	7	2	4	43	15
25,000-100,000	18	10	.....	.....	.....	.....	18	6
Over 100,000	3	2	.....	.....	.....	.....	3	1
Total.....	171	100	58	100	52	100	281	100
Area.....	Total acres 2,002,235	93	Total acres 101,919	4	Acres 76,009	3	Acres 2,180,163	100

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

² The Adirondack counties are: Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Saratoga, St. Lawrence, and Warren. The Catskill counties are: Delaware, Greene, Sullivan, and Ulster.

Taking the next to the last column in the table, it appears that we will have to deal with the inspection, supervision, and control of private forestry measures on at least 281 differently owned tracts, 78 per cent of which contain less than 25,000 acres. The average size of the privately owned forest in the Adirondacks is 11,709 acres, 1,757 acres in the Catskills, and 1,462 acres elsewhere in the State.

The region of the State in which we are most interested and for which it happens that our census data are most complete shows the following further conditions:

Conditions of privately owned timberlands in Adirondack Counties, New York. Based on 80 per cent in ownership of over 500 acres.

	Per cent.
Merchantable	50.0
Non-merchantable	27.7
Barren	10.9
Water	2.8
Not classified	8.6
Total.....	100.0

If, therefore, the Adirondack conditions are a fair criterion for those in other parts of the State, the proposed measures will be in active effect on only half the area, so far as merchantable timber is concerned; that is, of the 2,180,163 acres, not more than one-half, or 1,090,082 acres, would probably be classed as merchantable.

Coming to the second part of my paper, let us consider briefly what organization the State would need to inspect, supervise, and control the operations of private owners of 500 or more acres. It is obvious that for purposes of continuous forest production, some form of working plan will be needed for every property. I believe in requiring the owner to have such a plan prepared by a graduate forester and to file it with the Conservation Commission, which will approve or reject same. If it is approved, the working plan shall constitute the basis of operations, and the forest which it covers, for the 10-year working period. Departures therefrom, other than minor, shall require written approval of the commission.

Of course the plan itself will not produce proper forest practice but it is my thought that the filing of an acceptable working plan shall entitle the owner to certain privileges including (1) yield tax on the crop when cut, (2) free trees from State nurseries, (3) complete co-operation with the State in fire protection, and (4) the right to borrow capital needed for forestry practice for long terms at low rates of interest.

Conversely, failure to file such an acceptable plan and to inaugurate forest management after these various privileges shall have become

available, shall lead to forfeiture of the rights to these privileges, to State administration of the holdings for a 10-year working period, with costs + 4 per cent interest collected at the end thereof and, if the public interest warrants it and the owner continues obstinate in his mismanagement, to eventual expropriation. The New York law today provides that land may be appropriated "for the protection and conservation of the lands, forest, and waters within the State."

The inspection, supervision, and control of these working plans and of these properties, to carry out the scheme just proposed, requires that there shall be established within the Conservation Commission an office of Forest Management with a high-grade forester in charge. To this office will fall the duties of: (1) Reviewing all working plans submitted to it; (2) advising owners as to any changes therein it deems essential; (3) approval or rejection of the plans; (4) if approved, then *annual* visits to each forest and inspection of the operations thereon to make sure that the provisions of the working plan are being observed and executed; (5) written approval or rejection of departures from the plan; (6) revision or renewal of the plans at the end of each 10-year working period, which will be greatly facilitated if the owner keeps adequate control books, including a record of cuttings and plantings; (7) in the event of failure to file a plan or if the plan filed is rejected, this office must determine whether the public interest requires that the State take over the management of the property for the next working period; (8) if so, it falls to this office to handle the property and to keep all records so that costs plus interest may be levied at the expiration of the 10-year working period; (9) in the event of continued obduracy, this office shall decide whether to recommend the expropriation (appropriation) of the area in question.

To do all this for 300 separate parcels of land will require a staff of at least three extra foresters besides the head of the new office. One man can not handle over 100 such parcels to advantage and the chief of the office should be free to be a real executive.

The areas to be covered under this plan are approximately 2,002,000 acres in the Adirondacks, 102,000 acres in the Catskills, and 76,000 acres in other parts of the State, making 2,180,000 acres altogether.

Of course, where the forest is actually administered by this office, a temporary supervisor must be appointed. In the two chief regions, the district rangers and rangers can be of immense assistance in this respect.

Expensive? Yes. The chief of the office of Forest Management should receive \$1,000, and preferably \$5,000, yearly, the three assistants each \$2,500, or preferably \$3,000. With travel and incidentals, this office will annually require between \$15,000 and \$20,000. But, compared to the value of the resources involved, this is a mere drop in the bucket.

THE APPROXIMATE COST OF PRIVATE FORESTRY MEASURES IN THE ADIRONDACKS¹

BY HOWARD L. CHURCHILL

Forester, Finch, Pruyn & Company, Inc.

Accurate cost figures are today essential in any important line of work. I believe the lack of such figures in connection with logging operations in general and forestry measures in particular has been one of the principal reasons for the slow advance in conservative lumbering on private lands. Owners are slow, and perhaps justly so, in undertaking work of which they cannot know within reasonable limits both the cost and the returns.

It is unquestionably the work of the professional forester to determine what measures, silvicultural and others, are necessary to insure productive forests after lumbering, but it is not less his work to determine the cost of such measures and the returns to be expected and relied upon.

Evidently costs will vary with the size and location of the tract and the character of ground and timber, as well as with the measures employed.

Perhaps the most economically handled forest in any particular locality would be one just large enough to require the entire time and energy of a technically trained man, with such assistants as he might find necessary during the cutting season and in making surveys and tests in the woods and at the mills.

To make cost figures of any practical value or application, it becomes necessary to know just what work is covered by each cost item and how that work has been done. I have taken all costs from work on the property with which I have been connected for the past nine years, and hope the figures may be of interest and of some practical value. This tract covers about 150,000 acres in the east central Adirondacks, and is nearly all mountainous or rolling. In 1910 when preliminary work began, one-seventh of this area was first-growth spruce, balsam, fir, hemlock, pine, cedar, maple, birch, and beech, with the conifers largely predominating. Six-sevenths was second-growth

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

conifers and old-growth hardwoods, except a small percentage of waste and cleared land.

Costs of forestry measures are divided into three general classes—

First: Preliminary costs or valuation survey and office work resulting from same.

Second: Current expenses necessary in carrying out the various measures in connection with the property in general and the annual logging operations.

Third: Added cost to the regular logging operation due to the change in methods.

The first two are comparatively easy to answer, but the third we can only discuss until much more investigative work has been done.

Going back to the valuation survey; the field work which was carried out in the seasons of 1910-11-12 included the location of all property lines, the calipering of 5 per cent of all conifers 3 inches and up d.b.h., and hardwoods 10 inches and up, with an inspection of the hardwoods at the same time as calipered, to determine the percentage of waste and the amount of sound material per acre. For the most part, the regular strip survey was used, running parallel strips one-quarter mile apart perpendicular to surveyed lines one mile apart. Where the stand was too irregular, sample plats were taken and the acreage of cleared, burned, or barren areas paced or surveyed. The notes taken on consecutively numbered sheets showed the date, locality, type, slope and aspect, soil, ground cover, underbrush, reproduction, density and general condition as to age and ripeness of merchantable species. A good percentage of heights was taken in various sections of each type. Three men were used in a crew. Some stem analysis work was done, but much more has been done since in connection with the annual logging operations.

Five per cent of 150,000 gives us about 7,500 acres measured and the cost of this work, including the necessary surveying, was \$18,000, or 12 cents per acre. The stand of conifers large enough to make pulpwood and logs was, roughly, 450 million board feet, or about 3,000 feet per acre, making the cost per thousand feet .04. As before stated, one-seventh of this area was old growth and the age of the lumbering on the rest varied from one to about 50 years. The field work on second-growth is much more expensive, excepting hardwood slopes—and all this work would cost considerably more at the present time.

Working up the field data and writing a working plan, as well as mapping timber and topography, was largely done by the forester, and

cost \$1,500, or .03 per acre. This work was done during the winter. The U. S. Geological sheets served as a basis for topographic maps, but property lines were located on these and they were then enlarged to a scale of 4 inches to the mile.

The total preliminary costs were thus about 15 cents per acre, or .05 per thousand feet for the merchantable softwoods.

The annual cut from these lands has averaged 20 million feet b.m. Time and expenses for carrying out forestry measures each year are divided about as follows:

- A: General inspection of entire holdings to locate windfalls, keep in touch with the spread of diseases, the condition of dams, trails, telephone lines, reproduction and growth on recently logged areas, and take notes on the location and condition of logs in the streams and rivers. One month's time forester—cost \$400.
- B: Aiding the management in laying out log jobs for the season and getting work started. One month's time—cost \$300.
- C: Marking trees to be cut, and surveying boundaries of each area logged. Forester and two assistants. Three months' time—cost \$2,000, or 10 cents per thousand feet of logs cut.
- D: Making test measurements in the woods on logs and wood. Forester and one helper—one month—cost \$500.
- E: Time and cost studies in woods. One month's forester—cost \$300.
- F: Inspection of all operations. One month's forester—cost \$300.
- G: Making tests at the mills and office work mapping, and
- H: Working up field data and survey notes. Three months' forester—cost \$900.

Fire patrol during dry months by patrolmen—cost \$800.

Expenses in connection with telephones and tools in forest—\$200.

(Tools are also kept at all camps.)

Total cost, \$5,700, or 28½ cents per thousand feet cut annually.

With an average loss of 8 per cent in the river, this means about 31 cents chargeable against the logs delivered to the mill. With the preliminary cost of 5 cents this means 36 cents per thousand feet. The importance of this cost item varies greatly with the logging cost and with the quality of the logs when delivered.

When we come to consider the actual increase of cost in logging due to conservative methods, we have a problem which no forester or lumberman can answer at the present time, except by a careful study of the work as it goes on upon each logging unit. Perhaps a specific example might be of interest.

In June, 1912, we began cutting on a tract of 5,000 acres of first-growth spruce, hemlock, and pine. A part of the annual log supply has been taken from this area each year since, and it is now nearly cut through. In round numbers, 40 million feet b.m. will be total cut. Fifty million feet could have been cut by taking everything suitable for

pulpwood. The average annual cut has been five million feet, or one-quarter the total annual cut, and 625 acres have been gone over. With clear cutting 500 acres would have yielded the same amount. It has been necessary then to cut 25 per cent more land. According to time studies on this type, this means 5 per cent more time to get the same quantity of logs or 5 per cent more men to get the logs in the same time. With the average logging costs for the past eight years, this 5 per cent means about \$26,000, without considering any stumpage values, or 65 cents per thousand, or just \$1 per thousand with preliminary and annual costs. The ten million feet left represents the investment which must be carried until the next cut, probably 30 years. Now if we take preliminary and annual costs and net stumpage value of this ten million feet and carry them all forward 30 years, we get a cost figure per thousand feet which is not pleasant to look at. This would not be just, however, since I am convinced that the increased economies coming from increased knowledge more than compensate for the preliminary and annual costs, and the value per thousand feet of material used is a little higher than if the smaller trees had been included. Anyway, I believe conservative lumbering is necessary not only for the good of the State but the private owner. We have, however, a great amount of work to do in studying costs and much more in studying results. These questions the trained forester must answer and the need is great. We are only just beginning to know what takes place in the forest under various conditions. We should know what will happen, and why.

Comment by W. N. Sparhawk.

1. Churchill charges cruising of timber against *forestry*—shouldn't do it—any up-to-date lumberman cruises his timber and maps his holdings in order to log it more efficiently—cost should be charged against logging.

There are some charges connected with cruising properly chargeable against forestry administration—data on reproduction, silvicultural data, growth, etc. So much of cruising cost as is due to this may be charged to forestry.

2. Time and expenses for carrying out forestry measures—B is not chargeable to forestry. E is not chargeable to forestry.

Probably parts of D, F, G are also chargeable to logging rather than to forestry.

3. As C. suggests, it is likely that average value per thousand feet cut is enough higher where only the larger material taken, to

compensate for additional cost of logging. As a general rule, there isn't much profit in logging the small trees anyway. So this hardly a fair charge against forestry. The ten million feet left is most of it presumably left because it is young and growing faster than current interest rate; that is, pays better in form of timber than if converted into cash. So it is not a charge against forestry.

4. His idea of charging the costs (cruising, etc.) against present cut—that is, dividing per acre costs by present stand per acre, isn't right—with forestry should get much heavier average per acre stands and therefore lower per thousand costs.

5. The theory of charging up annual costs with compound interest until same area cut over again is based on policy of timber mining, not of a permanent investment. Such costs should be charged off currently.

6. I heartily agree with the last three sentences of the paper.

FINANCIAL LOSS TO THE COMMUNITY DUE TO FOREST LANDS BECOMING WASTES ¹

BY B. A. CHANDLER

Assistant Professor of Forest Utilization, Cornell University

When accepting the invitation to speak on this subject, I thought I knew where I could get some actual figures from communities with which I have worked. One man to whom I wrote has died, another has failed in business and moved away, and a town clerk did not answer my request. Therefore, all that I can give you is the result of my own observations in some of the communities from which I intended to get actual data.

The subject as assigned calls for the "Approximate financial loss to the community." We must bear in mind two truisms which we all recognize while we are thinking about this subject. The first of these is that much of the loss to the community, although very intimately connected with and perhaps caused by the financial loss, does not permit of direct expression in dollars and cents. The second is that the loss, financial and otherwise, so varies as any one of several factors change that it cannot be measured except in single concrete cases. For example, in a region like Grand Isle, Vermont, where a large percentage of the land is most valuable for the raising of annual farm crops, the creation of a small area of waste forest soil is a negligible loss. In other communities, an example of which I will describe later, the loss is so great as to result in actual bankruptcy to the community itself and in an unmeasured burden to the larger community outside. Between these two extremes are all graduations of insolvency.

Furthermore, the actual financial loss does not mean anything unless we have some measure of what that loss means to that particular community. Some of the New York papers, a few years ago, facetiously referred to the big fire in Bangor, Maine, as "little Bangor's big fire," and failed to appreciate what that fire meant, not only to Bangor, but to all the surrounding country.

¹ Delivered before the New York Section of the Society of American Foresters, at Wanakena, N. Y., July 29-31, 1919.

Thus, if we can make the public realize what the cost of the lack of permanent forest management is in the terms of humanity, it will not be necessary to express this loss in dollars and cents. This loss shows in the character of the community which is left behind, and in the labor conditions of the lumber industry. As an illustration of the former, I will describe the conditons of one community which I, at one time, knew very intimately.

This small mountain valley was originally well timbered with spruce and good northern hardwoods. The small areas of cleared land were considered farms in those days of farming by hand. The soil was fertile, but the side-hill-dodger could travel on it much easier than our modern farm machines. The early settlers were evidently of our good, energetic, Yankee stock, if we can judge by the houses they built, their photographs which still hang in the unused parlors, and the few grandmothers who are still living.

The condition we now find in this valley is not one we like to admit has grown out of the one just pictured. Destructive lumbering has reduced most of the forest to culled stands and young second-growth, the latter a pure gift of the gods. Forest fires swept across the head of the valley, taking much of the remaining spruce and leaving a trail of barren rock behind. As a result most of the energetic, courageous and far-seeing young people migrated. With few exceptions, the remaining individuals lacked the courage to move. Decrease in cash crop, discouragement, and whiskey caused increasingly poorer farming and poorer cooking, malnutrition, decreasing energy, and poorer schools. All these factors intensified by intermarriage formed an inclined plane shooting downward towards a degenerate community.

This is not an isolated case, but is only one of many communities which I have found in similar or worse conditon. Neither are such communities confined to any particular State. Every time I have had an opportunity to study one of these communities, I have been able to trace the primary cause to the fact that the economic basis had dropped out from under it.

The cost of destructive lumbering and forest fires to the community dependent on the products of a forest soil is their physical, mental, and moral bankruptcy. The cost to the larger community is even harder to estimate. Of course, such communities have to have proportionally more help on roads and schools. It is supposed that such communities contribute more than their proportion of the inmates of our reform schools and insane hospitals. They certainly do not contribute their share of energy and progress to the larger community.

There is no data to enable us to predict towards what we are drifting. The data from Europe is so conflicting and so many different factors are involved that no safe conclusions can be drawn from them. We are producing a type of degeneracy all our own, and what this burden may amount to in the future, if we continue to produce community after community of this kind, cannot be predicted. But the degenerate community is not the only cost, in terms of humanity, of the migratory character of our lumber industry.

Because of this migratory character, the men have seldom been able to establish homes. I believe that this fact has been a strong force degenerating and driving from the industry its labor. The American and Canadian woodsmen have already gone this trail, and the Russian and Pole are following them. In the *American Lumberman* of June 7 you will find my ideas on this subject expressed more fully.

Although not the only factor involved, it seems that the cost to society of creating large areas of waste or partial waste forest soil is human degeneracy.

THE DISPOSAL OF INFECTED SLASH ON TIMBER-SALE AREAS IN THE NORTHWEST

BY ERNEST E. HUBERT

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In discussing the practical relations of forest pathology to forest management, the question is often raised by foresters of the extent to which sporophores of fungi develop on infected slash left upon sale areas following logging operations, and the bearing which this development has upon the health of the remaining stand. This problem has been given but slight, if any, attention, and its importance in connection with the ever-increasing efforts to improve the health of the forests should not be underestimated. The longevity and spore production of fruiting bodies developing on slash following the logging operations are the two main factors involved. Since infection of sound trees by a majority of forest tree diseases depends unquestionably upon the presence or absence of the spores or seeds (in case of mistletoe) producing the infection, it is readily seen that the unrestricted production of fruiting bodies in the vicinity of susceptible trees will result in the spread of disease and consequent loss of valuable timber. A certain amount of infection is brought about by contact between interlacing roots. This method of infection can not be considered here.

In order to check the spread of disease and reduce the attendant loss on the sale area and the surrounding stand, some disposition should be made of the infected slash left on the ground following the logging operations, since this infected slash is capable of bearing sporophores of the more harmful fungi, and these act as distributors of the diseases. If proper pathological marking³⁵ has been applied to the area the slash will consist of a certain number of infected, unmerchantable trees which were cut and left upon the area to be disposed of along with the brush. The reproduction on the sale areas, and the reserved sound seed trees represent an investment which must be

NOTE—Thanks are due Dr. J. R. Weir for helpful suggestions and a part of the data used in this paper.

protected as much as possible from all manner of disease. This protection from disease is aimed at reducing the chances of infection through fungi, and the subsequent loss by decay or death, and favors the development of a maximum of healthy trees for future cutting. The prevention of sporophore formation is, therefore, the principal method by which such protection can be secured.

FACTORS CONCERNED IN THE PRODUCTION OF SPOROPHORES

Various factors are concerned in the production of fruiting bodies by forest tree fungi, some of which can not be taken up in detail here. The most important can be grouped under two heads, the internal factors or those depending upon the conditions within the host, and the external factors or those depending upon conditions present outside of the host. Of the internal factors, the principal ones are as follows: (1) the stage of development of the mycelium in the wood, (2) the available water supply, (3) the available supply of air, (4) the available food supply, and (5) the resistance to sporophore formation offered by the host.

The important external factors are (1) temperature, (2) moisture, (3) light, and (4) gravity. In the case of the Polypores a certain period of development of the vegetative part of the plant is necessary before sporophores are produced, and in the case of heart-rotting fungi the stage of the rot is always sufficiently advanced to be plainly recognized when fructification begins. This has been found true in the studies made of *Echinodontium tinctorium* attacking western hemlock and grand fir,^{31 33} and *Trametes pini*, *Polyporus schweinitzii* and *Fomes annosus* attacking western white pine.³² In every case where sporophores were present upon the host the rot within the tree, at least in the infected area supporting sporophores, was always found to be in a stage fairly well advanced and easily recognized. Hartig¹¹ states that *Trametes pini* produces sporophores only when the fungus has developed luxuriantly in the interior of the tree. Meinecke,¹⁶ in discussing fungi which attack forest trees, says: "The fruiting bodies are only formed after the fungus in the host tree has reached a certain maturity at the cost of the tissues they live in."

The development of the fungous mycelium within the host depends upon the available water, food and air supply. The absence of sufficient moisture even in the presence of a bountiful supply of food material will cause the fungus to cease development and finally die. This often happens to sections of infected trees left in dry, exposed

areas where the action of the sun and wind soon removes the required moisture from the wood tissues, and thus completely checks the development of the disease within. In many cases where the above conditions exist it often happens that a more xerophytic fungus is able to secure a foothold in the dead host and successfully develop fruiting bodies. In this manner the moisture factor in a large measure restricts the activities of the less xerophytic fungi and favors the xerophytic types.

The majority of literature dealing with wood rotting fungi records that the resin formed by the host acts as a protective element as well as a means to resist the advance of the mycelium within the host tissues. Resin also plays an important part on certain hosts in preventing the development of sporophores and causing the production of abortive ones. In western white pine, western larch, and other conifers attacked by *Trametes pini*, resin flows, and swellings at branch whorls are characteristic symptoms of a diseased condition within. The flows and swellings are outward indications of the reactions of the host to the activity of the fungus in certain branch knots, and prevent, to a certain extent, the production of fertile sporophores. Digging into these branch knots with the corner of an axe or hatchet reveals underneath the resin coating a mass of brownish mycelium of the same context as the sporophores of *T. pini*. Small abortive sporophores are thus produced at the branch whorls, and these rarely recover sufficiently to produce a hymenial surface and spores. Very often these abortive sporophores take on peculiar shapes, the most interesting have been of *Echinodontium tinctorium* and *Trametes pini*.³⁰

Sporophores developing on dead and down timber have no live sap zone to prevent their emergence upon the host surface. The air supply is at least greater than when the tree was live and standing, and the only factors influencing the development of sporophores are the factors of food and moisture supply, and such external factors as may prevent their appearance on the surface of the host. Moisture is by far the most important influence, for without sufficient moisture, even if food and sufficient air were present, the development of the fungus is bound to be checked.

It has been noted that remarkably fewer fruiting bodies appeared in the forests during the exceptionally dry years than in the years in which rain was plentiful. This fact tends to show that lack of moisture due to continued high temperatures reduces the sporophore production appreciably.

Lack of sufficient atmospheric moisture should also be considered in connection with sporophore production. Work bearing on this subject has been done in connection with a study of the effect of thinning on the sporophore production on trees left on the area.³¹ Although not conclusive, the results of the study indicate that the sporophore production is checked by the thinning. Abbott¹ and von Schrenk²⁵ refer to the relation of moisture to fungous development, but do not state the effect upon sporophore production. Abbott, by experiments, showed that wood infected with *Trametes pini* and kept moist continued to support live mycelium, but that lack of moisture soon caused death.

Light as a factor in sporophore production has been recognized for some time, and considerable has been written concerning it. Goebel,⁹ Buller,³ Bayliss,² Long,¹³ and Long and Harsch¹⁴ have shown by experiments that certain wood-rotting fungi cultured in darkness will not produce fertile sporophores, but that the same fungi cultured in a certain density of light produce them readily. Goebel, quoting from Schröter, states that wood-rotting fungi growing in coal mines have sporophore development visibly affected by the absence of light, and Long and Harsch¹⁴ have definitely demonstrated by cultures that light is necessary to produce fertile fruiting bodies in a certain number of fungi, and that three species of Polypores developed fertile sporophores in absolute darkness.

Light, in the majority of cases, it seems, is first needed to produce the primordium of the fructification, and following this, gravity is active in properly aligning the tubes of the hymenium or the gills so that they are at right angles to the surface of the earth. This arrangement makes it possible for the growing fungus to first secure a place open to the light for the production of sporophores and proper dissemination of spores, and, second, guides the arrangement of the hymenial surfaces in such a way as to secure the distribution of a maximum number of the spores.

Moisture is, no doubt, the predominating factor in determining the continuous activity of forest tree fungi in infected slash, and is of prime importance in the development of fruiting bodies. A study of the moisture conditions and the attendant fungous activity on any particular area would greatly aid in determining the intensity of control necessary to remove the danger of sporophore production on the infected slash left upon the area.

PRODUCTION OF SPOROPHORES FOLLOWING THE DEATH OF THE HOST

Discussion of Literature

Scattered throughout the literature on forest pathology are brief references bearing on the longevity of the fruiting bodies of the more important forest tree fungi which attack the host when alive and develop upon it when dead. Among these and others are found references which deal with more or less purely saprophytic fungi, but which are included in order to complete the available data on the subject of sporophore longevity upon down and dead material. These references are, in the main, brief statements by the authors as to whether or not the fungi under discussion, either as vegetative mycelium in the wood, or as old or newly produced fruiting bodies, continue viable for any length of time after the death of the host. A few contradictory references are found, but the majority express the opinion that the sporophores of certain fungi remain viable and new ones are produced after the tree is down and dead. Buller,^{3 4} and Buller and Cameron⁶ have shown that the fruiting bodies of a number of the common Hymenomycetes will undergo desiccation for long periods without losing their ability to produce spores. The fungi used in the above experiments are not important from the viewpoint of forest pathology, and the information is given to indicate the possible longevity of some of our more harmful heart-destroying species, and the bearing of this phase upon the problem here treated.

In describing the "pecky" rot of *Taxodium distichum* and *Libocedrus decurrens*, von Schrenk²⁰ makes the interesting statement that "this wood can be utilized for many purposes even when much rotted, and in neither case does the mycelium grow after the tree had once been cut down." Later in 1900,²² writing an account of the fungi found attacking New England conifers, he states that the sporophores of the following fungi develop upon the standing living hosts, as well as upon those which have been cut down: *Polyporus schweinitzii*, *Fomes pinicola*, *Trametes pini*, *Polyporus sulphureus*, *Peoria subacida*, and *Poria vaporaria*. In regard to *Trametes pini*, he states "the sporophores . . . grow both on living and fallen trees. They were found on trees which had been cut down four years before, and new ones were constantly appearing. It is this faculty of fruiting on dead trees that must enable this fungus to spread through a forest in a very short time, and accounts for the fact that it does so." No evidence is brought forth that the characteristic form of decay continues in the fallen tree, and he further states that "the present view

seems to indicate that it does not grow after the death of the tree." In another work, discussing the fungous diseases of forest trees, the same author²³ makes the general statement that "In the majority of cases the fruiting bodies do not form on the trunk after the fall of the tree." *Trametes pini* is given as an example, and this statement apparently contradicts the preceding reference. In a study of the diseases of the hardy catalpa, von Schrenk¹⁸ states that *Polystictus versicolor* will not attack or continue its growth upon this host after the tree is cut. Stevens¹⁷ has demonstrated that the reverse is true, and finds that the wood of this host is quite generally attacked by other saprophytes as well. *Fomes pinicola* (*Polyporus ponderosa*) was found by von Schrenk²⁵ to develop readily on fallen trees of *Pinus ponderosa*, forming as many as 20 or 30 on a log 10 feet in length favorably placed in regard to available moisture. *Polyporus fraxinophilus* is found by von Schrenk²¹ to develop only on its living host and not upon fallen trees. In 1907,¹⁹ discussing *Polyporus lucidus*, he states that "the fruiting organ of this fungus in one case developed in about two months from the time the trees were cut down," and later, in 1908,²⁴ he says of *Polyporus rimosus* that the sporophores develop only upon living trees.

Von Schrenk and Spaulding in 1909,²⁶ in a study of the diseases of deciduous forest trees, find that *Armillaria mellea*, *Fomes igniarius*, *Polystictus versicolor*, *Polyporus sulphureus*, *Fomes applanatus*, and *Fomes fomentarius* continue alive and produce sporophores for a considerable time on down and dead timber, and that in the case of *Fomes rimosus* sporophores are not produced on fallen infected wood. Weir has found sporophores of *F. rimosus* in Indiana developing on down trees. Many other fungi are mentioned as developing fruiting bodies on down timber, but the majority of them are primarily saprophytic and rarely attack the living hosts. Faull⁷ states that *Fomes officinalis* (*F. laricis*), a harmful, timber-destroying fungus, is often found fruiting on the down portions of its hosts.

Buller,⁵ writing on *Polyporus squamosus*, states that when a tree has been killed by this fungus it still continues its annual production of sporophores, and Freeman,⁷ writing of the same fungus, states that it is usually found on dead logs and stumps. More recently Abbott¹ in 1915, working with *Trametes pini*, found "that the growth of the mycelium in fallen trees is dependent almost entirely upon moisture conditions," and demonstrates this by experiments with infected wood, but believes "that trees which fall in the woods as a result of permeation by the fungus do not fall ordinarily under such conditions as

tend to favor the continued growth of the mycelium." This last fact may be true for the region Abbott studied, but is certainly not the common condition in the forests of the Northwest.

Practically all the heart-rotting fungi which attack living trees in the Northwestern region retain their vitality after the tree is cut,²⁷ and if the moisture conditions are favorable the activities of the mycelium will continue as long as sound material is available. If conditions favorable to the production of fruiting bodies are present, then sporophores can be expected to develop on down timber, providing the mycelium within the host has reached that point in its development. These sporophores are capable of distributing millions of spores during one season. Buller⁵ computed from partial counts that on an average of 1,700,000 spores were produced from each pore on the lower surface of *Polyporus squamosus*, or a total of more than eleven billion for the entire lower surface, which had an area of 38.75 square inches. An average of two million spores a minute is recorded for this fungus during two or more days. This gives an idea of the great number of spores that may be liberated upon a cut-over area where numerous sporophores of the more harmful species of all sizes are developing continuously.

The factors of shade and moisture as they exist upon a cut-over area greatly influence the production of sporophores appearing upon the slash infected prior to cutting. The drying effects of an open, exposed area having few living trees and little or no brush supplying shade, would, no doubt, retard the sporophore development on both down material and upon the few standing living trees. This has been demonstrated for standing trees in a study of the effect of thinning on the sporophore production on grand fir and hemlock infected with *Echinodontium tinctorium*,³³ previously referred to. But it must also be remembered that with the return of a dense cover of brush and reproduction, the required moisture and shade conditions may be restored and sporophores developed upon the infected slash lying in the shadier and more moist sites.

Infected cull logs lying in close contact to the ground are unquestionably better situated for the continuous development of the attacking fungus than a similar log not in contact with the ground and subject to rapid drying by a free circulation of air about it. Ground moisture is readily absorbed by wood in contact with the ground, and this serves as a reservoir of moisture to the fungus within the log. Long¹³ found that certain saprophytic fungi were able to attack the brush only when the brush was in close contact with the ground, and

was thus able to draw upon the ground moisture. He also states that the fungi found attacking branches lying in contact with the ground were of the type which needed moisture for their development. This group of fungi includes those normally found attacking stumps and posts.

Field Data

In order to secure an idea of the number of sporophores of fungi found developing upon infected slash on cut-over areas, data were collected from various localities in Oregon, Idaho, Montana, and Minnesota.

The writer has collected data on eighteen separate Forest Service sale-areas and three private operations in Idaho and Montana, covering the principal types in District 1 (Northern District) in which timber sales are active. Sample plats were taken on ten of these and only a few are given in connection with this paper.

Before presenting the data it would be well to define the term "slash." In the strict forestry sense "slash" is defined as the debris left upon the ground as a result of logging, wind or fire.³⁷ In this discussion the term "slash" is intended to cover all the debris left upon the ground as a result of logging, with the exception of all debris included under the term "brush." Brush ordinarily includes material up to, and including 4 inches in diameter.

A few random observations are first presented in order to show the common occurrence of sporophores of some of the most important fungi upon down material.

In this connection it is necessary to point out that the period when the sporophores were produced, whether before logging or following, was determined by the positions of the sporophores on the down material. The horizontal axes of those produced after logging are approximately at right angles to those produced while the tree was standing.

In the Priest River region of Idaho in 1914 several trees of Western hemlock and grand fir were felled and dissected in a study of the heart rot caused by *Echinodontium tinctorium*. These trees were cut into various lengths and many notches were cut in the logs during the process of the study. The site is a damp and very shaded area located upon a small "island" formed by the river. In 1915 the area was visited, and it was found that two hemlock logs and five grand fir logs bore a total of nine young sporophores of *Echinodontium tinctorium* in the notches, at the sawed ends and upon the lower and

shaded portions of the logs. Those logs not in direct contact with the ground developed no sporophores. This demonstrates the rapid and comparatively numerous production of fruiting bodies on fallen trees under favorable environment.

On this area a large Engelmann spruce infected with *T. pini* was felled and cut into log lengths in August of 1914. When felled the rot, although well advanced, occupied only a portion of the heartwood, and when examined in September, 1915, large portions of the sapwood had been invaded, and small, young sporophores producing spores had developed from the sap zone on the ends of two of the logs. This observation indicates a more rapid development of the rot in the host after felling than was apparent when the tree was alive, and shows how soon after the tree is down the sporophores begin to appear. An additional six months would have produced large sporulating fruiting bodies upon these logs.

On a cut-over portion of the Lindberg Creek area on the Coeur d'Alene National Forest, in 1916, several cull logs of western white pine (*P. monticola*) left on the ground along one of the logging chutes, were observed to have the unmistakable cubical butt rot caused by *Polyporus schweinitzii*. The majority of the logs, 11 in all, upon examination were found to bear sporophores of this fungus issuing from various surfaces. All the sporophores were produced in 1916, except one which had developed in the preceding year. These fruiting bodies were large and presented a formidable menace to the remaining living white pines upon the area. Many of the *P. schweinitzii* fruiting bodies, both dead and alive, were observed in the duff near the base of white pine and Douglas fir (*Pseudotsuga taxifolia*) stumps upon this area. In the same year, on the old Silver Creek cutting logged off in 1915, in the same forest, several cull logs of western white pine were noted, some with new "conks" of *T. pini* and others with fresh sporophores of *P. schweinitzii* upon them. In all the cases cited, the sporophores of saprophytic fungi, and *Fomes pinicola* in particular, were quite numerous upon the slash left upon the cut-over areas. *T. pini* was very common on old snags. At least 50 per cent of these were capable of producing spores or had already produced them that season. Sporophores were more numerous upon logs in direct contact with the ground than upon windfalls, culled trees and logs, etc., which were supported several feet from the ground by other logs or trees.

On the cut-over area logged in 1907, near Seeley Lake on the Missoula National Forest, the following observations were made in

1917. The stand originally consisted of a mixture of western larch (*Larix occidentalis*), Douglas fir, lodgepole pine (*Pinus contorta*), and western yellow pine (*Pinus ponderosa*). The majority of the larch cut were long-butted, and the rejected parts were left on the area. A large amount of slash of all species was left on the area, including infected snags, a few old windfalls, and considerable rejected unmerchantable wood. On an area of approximately one acre, sporophores of *Fomes laricis* growing on larch were noted as follows: On one standing dead snag, 2 sporophores, 1 live and 1 dead; 1 windfall, 3 live sporophores; on 5 rejected butts and 3 stumps, 10 sporophores, 8 live, and 2 dead. On one windfall of Douglas fir 2 large and live groups containing 14 fruiting bodies of *Polyporus sulphureus* were found, and 1 live group containing 6 fruiting bodies of the same fungus on one butt log which had been culled. Of *Fomes pinicola* on the stumps, cull sections and windfalls of the various conifers represented on the area, 18 sporophores were found. Most of these were dead, having developed soon after the area had been cut over. The above items, summarized, give a total of 35 live and dead sporophores (excluding *F. pinicola*) of the more harmful fungi found upon cull material on this area. Each of these at one time or another, since the area was cut, produced a large number of spores, of which a few no doubt found their way to nearby susceptible trees and infected them. The Douglas fir windfall infected with *P. sulphureus* was found to have fallen across an old log badly rotted by the above fungus. The contact between the two was such as to allow of the infection of the Douglas fir by growth of mycelium from the old log.

The following tables give a summary of the number and species of sporophores found upon three separate logging areas. The number of cull logs, poles, stumps, etc., upon which the sporophores were found, was, unfortunately, not recorded. The number of pieces of cull is, however, not as important in this connection as the total number of harmful sporophores produced upon the area. All of the species of fungi, excepting one, given in the tables, are of pathological importance in the regions indicated, and are found attacking living trees. Of the entire list *Fomes pinicola* is the least important, since it is primarily a saprophyte developing upon dead material, and rarely attacks living trees as a heartwood fungus. Table 1 gives data on a cut-over area 10 years following logging operations in the Priest River region of Idaho. The site, both before and after logging, was favorable to fungous growth, although to a lesser degree after cutting, due to the opening up of the stand. The stand was of the western

TABLE 1.—Number and condition of sporophores found on stump and cull logs upon cut-over area of 5 acres 10 years following logging operations. Priest River, Idaho.

Fungus	Host	Part of host to which sporophores were attached		Sporophores at time of observation				Remarks
		Stump	Trunk	New ¹ No.	Old ² No.	Live No.	Dead No.	
Trametes pini.....	Pinus monticola.....	x	...	8	5	10	3	Some resupinate forms.
	Pinus monticola.....	x	...	0	3	3	...	At root crotch.
	Picea engelmanni...	x	x	7	8	15	0	Resupinate on cull logs.
	Thuja plicata.....	...	x	4	6	10	0	Culled poles.
	Pseudot. taxifolia...	x	x	3	5	7	1	Culled logs.
	Larix occidentalis...	...	x	4	2	6	0	Culled logs.
Fomes laricis...	Abies grandis.....	...	x	1	3	4	0	Culled logs.
	Tsuga heterophylla...	...	x	0	2	2	0	Culled logs.
	Larix occidentalis...	...	x	2	1	3	0	Resupinate form.
	Larix occidentalis...	x	...	3	1	4	0	From fire scars.
Fomes annosus..	Pseudot. taxifolia...	...	x	0	2	2	0	Old spor. with re-adjusted pore surf.
	Picea engelmanni...	...	x	1	1	2	0	Culled logs.
	Tsuga heterophylla..	x	x	2	3	5	0	End of cull, butt, and root crotches
	Pinus monticola.....	x	...	...	3	3	0	Root crotch.
Polyporus schweinitzii....	Abies grandis.....	x	x	1	2	3	0	End of cull, butt, and root crotch.
	Larix occidentalis...	...	x	3	0	3	0	Cull butt.
	Larix occidentalis...	x	x	2	1	2	1	Cull butt and stump.
	Pinus monticola.....	x	x	3	0	3	0	On cull butt and near stump.
Polyporus sulphureus	Pseudot. taxifolia...	x	x	2	0	2	0	On cull, butt and on root crotch.
	Picea engelmanni...	x	...	1	0	1	0	On stump.
	Abies grandis.....	x	...	1	0	1	0	On root crotch.
	Tsuga heterophylla..	x	...	1	0	1	0	On stump.
Echino. tinctorium	Larix occidentalis...	...	x	12	0	12	0	On cull butt.
	Pseudot. taxifolia...	...	x	6	0	6	0	On cull butt.
Hydium abietis...	Abies grandis.....	...	x	1	6	2	5	On culled logs.
	Abies grandis.....	...	x	2	7	3	6	On culled logs.
Poria weirii	Abies grandis.....	...	x	1	0	1	0	On culled log.
Pholiota adiposa..	Thuja plicata.....	x	x	1	0	1	0	Cull butt and stump.
Fomes pinicola ³ .	Tsuga heterophylla..	...	x	4	...	4	...	On culled butts.
	Abies grandis.....	...	x	11	...	11	...	On culled butts.
	Abies grandis.....	...	x	1	1	2	0	Culled logs.
	Abies grandis.....	x	...	1	2	3	0	Culled logs.
Totals.....	Tsuga heterophylla..	...	x	0	1	1	0	Culled logs.
				89	65	138	16	

¹Those developed since tree was cut. All 9 years old or less.

²Those developed before tree was cut.

³Rarely attacks living trees.

TABLE 2.—*Number and condition of sporophores found on stumps and cull logs upon cut-over area of between 4 and 5 acres, 13 years following logging operations. Superior National Forest. [North exposure dense stand.]*

Fungus	Host	Part of host to which sporophores were attached		Sporophores at time of observation				Remarks
		Stump	Trunk	New ¹ , No.	Old ² , No.	Live, No.	Dead, No.	
Trametes pini.....	Larix laricina .....	...	x	8	10	18	0	Culled logs.
	Pinus strobus .	...	x	4	6	10	0	Culled butts.
	Picea mariana.....	...	x	3	4	7	0	Culled butts.
	Pinus banksiana .....	...	x	2	3	4	1	Culled butts.
Fomes annosus .	Abies balsamea.....	x	...	1	2	3	0	Root crotches.
Polyporus schwein-itzii.....	Tsuga canadensis...	x	...	2	3	5	0	Root crotches.
Fomes pinicola ³	Pinus monticola	x	x	2	0	2	0	Stump and culled butt.
	Larix laricina .....	...	x	2	1	2	1	Culled log.
Totals				24	29	51	2	

¹ Those developed since tree was cut. All 12 years old or less.² Those developed before tree was cut.³ Rarely attacks living trees.TABLE 3.—*Number and condition of sporophores found on stumps and cull logs upon cut-over area of between 4 and 5 acres 14 years following logging operations. White Pine, Oregon. [Yellow-pine type. Flat rolling site.]*

Fungus	Host	Part of host to which sporophores were attached		Sporophores at time of observation				Remarks
		Stump	Trunk	New ¹ , No.	Old ² , No.	Live, No.	Dead, No.	
Trametes pini.....	Pinus ponderosa.....	...	x	0	1	1	0	Culled butt.
	Larix occidentalis...	...	x	0	1	0	1	Culled butt.
	Pseudot. taxifolia...	...	x	1	1	0	2	Culled butt.
Fomes laricis ...	Pinus ponderosa.....	...	x	1	2	1	2	Culled top.
Polyporus anceps...	Larix occidentalis...	x	x	1	2	1	2	Stump and culled butt.
Polyporus ellisianus	Pinus ponderosa.....	...	x	2	0	2	0	End of culled butt.
	Pinus ponderosa.....	...	x	1	0	1	0	Fire scars of culled butt.
Totals				6	7	6	7	

¹ Those developed since tree was cut. All 13 years old or less.² Those developed before tree was cut.

white pine type. The data show a total of 154 sporophores, both live and dead, observed on a variety of slash and of hosts. Of the sporophores, 89 were developed after, and 65 previous to the cutting, and 138 or 90 per cent of the total sporophores were found alive, with a much smaller number (16) dead. All of the new sporophores were found to be alive, and this indicates that 49 of the old ones remained living up to the time of observation. The data in Table 1 indicates that *Trametes pini* is by far the most active of the fungi present in respect to the number of sporophores developed. Of the total sporophores on the area, 61 were *T. pini*. Of these a large majority (93 per cent) were found alive. Seven different hosts were found bearing these fruiting bodies which were developing on stumps, cull lots, cull poles and cull parts of logs. These figures are all the more important if it is considered that this fungus is one of the most destructive agents in the rotting of valuable timber in the Northwest region. The principal tree of the future crop, western white pine, is one of the most common of its numerous hosts. The large number of live sporophores developing upon the slash on this area is representative of the conditions existing upon cut-over areas in the timber regions of the Northwest where private logging is carried on. The timber sales conducted by the Forest Service, due to the enforcement of closer utilization policies, always show a marked improvement in this respect over the operations conducted by individuals and contractors upon private holdings.

Tables 2 and 3 record data taken upon cut-over areas in Minnesota and Oregon, respectively. These areas were cut under Forest Service regulations, and show a marked difference in the number of sporophores found, and also in the amount of cull material noted in comparison to the area of Table 1. The true difference in the areas is not correctly shown by the total number of sporophores recorded in the tables, since the sizes of the areas varied in each case, and the Priest River area, due to climatic, topographic and type factors, is normally more favorable to fungous development than the Oregon area. The Oregon area is characterized by the following climatic summary²⁸ compiled from the reports of the United States Weather Bureau: (1) scanty rainfall, (2) wide range of temperatures, (3) low, absolute humidity, (4) rapid evaporation, and (5) an abundance of sunshine.

The Minnesota area, situated originally in a dense stand on a north slope, presupposes the development of a larger number of sporophores than that of the Oregon area, which site is flat, rolling, drier and less

TABLE 4.—Number and condition of sporophores found on infected slash upon cut-over area 12 years following logging operations. Area of sample plat, 2 acres, near Coeur d'Alene City, Idaho.

Fungus	Host	SPOROPOHORES				Slash
		Old ¹		New ²		
		Live, No.	Dead, No.	Live, No.	Dead, No.	
Trametes pini.....	Larix occidentalis...	2	5	35	4	1 top—25 feet long
	Larix occidentalis...	1	2	7	0	1 log—16 feet long
	Larix occidentalis...	0	0	19	0	1 log—12 feet long
	Larix occidentalis...	0	6	45	0	1 log—20 feet long
	Larix occidentalis...	1	10	28	0	1 log—20 feet long
	Larix occidentalis...	3	3	32	0	1 log—16 feet long
	Larix occidentalis...	0	0	12	18	1 log—16 feet long
	Larix occidentalis...	0	8	11	0	1 log—14 feet long
	Larix occidentalis...	0	0	12	0	1 log—12 feet long
	Larix occidentalis...	0	1	2	1	1 stump
Polyporus schwein- itzii.....	Larix occidentalis...	0	0	2	0	1 branch—8 in. diameter
	Pinus monticola....	0	0	2	0	1 log—16 feet long
	Pinus monticola....	0	0	0	2	1 log—16 feet long
	Pseudotsuga taxi- folia.....	0	0	0	0	6 on stump: 1 stump 4 on ground:
	Pseudotsuga taxi- folia.....	0	0	1	3	1 butt—log 12 feet, 34 inches in diameter
	Abies grandis.....	0	2	0	0	1 tree cut and left in open space
Echinodo- ntium tincto- rium.....	Abies grandis.....	3	0	0	0	1 log—12 feet long
	Abies grandis.....	1	2	1	0	1 log—10 feet long
	Abies grandis.....	2	0	1	0	1 top—18 feet long
	Tsuga heterophylla..	0	2	1	0	1 log—10 feet long
	Tsuga heterophylla..	0	1	0	2	1 log—16 feet long
Fomes laricis....	Larix occidentalis...	0	0	1	0	1 stump
Four fungi	Five hosts.....	13	42	212	40	22 pieces infected slash

(Total of 307 sporophores)

¹ Those developed before tree was cut.² Those developed since tree was cut.

favorable to fungi. On the former area, out of a total of 53 sporophores recorded 51, or 96 per cent, were found alive. A higher percentage than recorded in Table 1. Again we find *T. pini* in the majority, with a total of 40 live and dead sporophores comprising 75 per cent of the total sporophores on this area. Of the *T. pini* sporophores 39, or over 97 per cent, were alive. Of the new sporophores all (24) were alive, and 27, or 93 per cent of the old, were found alive.

The Oregon area had a total of 13 live and dead sporophores, of which total 86 per cent were alive. The one old sporophore found was dead. On this area *Fomes laricis* had the largest number of sporophores (6), being 46 per cent of the total number alive and dead.

Table 4 gives data taken on a private cutting twelve years following logging operations. This plat is a good illustration of the results to be expected in the western white pine type of forest when no attention is paid to disposal of slash and brush, and no definite plan is made before logging to secure a maximum return from future cuttings. It is typical of the majority of private logging operations which are not under Forest Service supervision and may give some idea of the development of fungous sporophores where no forest regulation is practiced.

The area has a high fire hazard during the dry season, due to the tangled condition of the brush, slash, and windfalls left on the area. The trees left on the area after logging, along with the reproduction which has since developed, form a fairly dense covering, producing much shade. This, combined with the heavy annual rainfall, creates a favorable environment for the development of fungous sporophores. The data show that on the two acres surveyed, there were 22 pieces of infected slash left on the area, which bore a total of 307 fruiting bodies of the more harmful fungi. Of this total, 212 of those produced after logging were alive and 40 dead, and 13 of those produced before logging were alive and 42 dead. Again, in this sample plat the sporophores of *Trametes pini* are found to be the most abundant, being 88.5 per cent of the total sporophores recorded. Of the total *Trametes pini* sporophores 85 per cent were alive. *Echinodontium tinctorium* was second in abundance, with a much lower figure, 5.8 per cent. An interesting part of the data in Table 4 is the large number of sporophores of *Trametes pini* found on certain of the cull logs and tops. One side of one of the logs was literally covered with them, and little space left for new ones to appear. On this area it was noted that where infected slash was left in openings where sun and air were important drying factors, comparatively fewer sporophores appeared following the logging operation.

Three of the areas showed the sporophores of *T. pini* to be the most numerous, and a high percentage of the total were found to be alive. This fungus is one of the most widespread and destructive found attacking forest trees. Its rapid spread through a growing forest, and its ability to develop abundantly and over long periods of time upon down timber,^{22 27} make it, possibly, the most important fungus considered in the study. All of the infected slash given in the tables and producing sporophores was material in close contact with the ground. In many cases upon sale-areas where saprophytic fungi were found attacking down material, it was noted that the de-

cayed area was greatest in that portion of the log in contact with the ground. It will be noticed that stumps and roots of stumps are commonly found with sporophores upon them. This emphasizes the relation of infected slash to the soil moisture, and the resulting effect upon fungous activity and the production of sporophores.

THE DISPOSAL OF INFECTED SLASH ON SALE AREAS

Discussion of Methods

Under the present practice of forest management, a portion of the slash is always removed from the cut-over area by the operation of brush disposal. Brush disposal in the Northwestern forest region consists mainly of piling and burning the debris, not to exceed 4 inches in diameter, left by the swampers in trimming a felled tree. This operation is carried on principally for the purpose of reducing the fire hazard to a minimum. Incidentally it removes a certain amount of the larger slash which occasionally is burned with the brush. It is also used to kill undesirable trees or trees of inferior species, by piling the brush at the bases of such trees. In this manner many are killed, and reseeding of the area to these undesirables is reduced.

The problem here presented is concerned with the slash scattered upon the area which is not piled and burned and is thus left, not only as a future fire menace, but also a menace to the health of the remaining stand if sporophores of wood-destroying fungi are developed upon it. It concerns principally such infested slash of a size larger than is usually burned as brush.

The data show that considerable numbers of sporophores of the more harmful species of fungi are found developing on a great variety of slash left on logged-off areas and these fruit bodies are capable of shedding an immense number of spores during their growing season,^{3 5}. The majority of sale areas contain and are surrounded by valuable trees susceptible to fungous infection. Distance is no obstacle to the transmission of spores from points within a clean-cut area to the edges of the cutting, for the air currents are capable of carrying these spores many miles. Reproduction, whether natural or artificial, should be protected and can not be if fungous enemies are allowed to develop, first, upon the infected slash, and second, upon surrounding living trees. It is evident, then, that slash left upon a sale area is a menace to the successful practice of forestry in the following ways: As a fire menace, and as a disease infection menace.

It is realized that economic conditions enter as a very important factor in determining control methods which would in some cases call

for a possible increase in the cost of logging. Nevertheless, future values and future losses should not be overlooked in efforts to keep the cost of production at a minimum. Like all other progressive steps in forestry, forest hygiene has already found a place in the scheme of forest management as witnessed by the progress the Forest Service has made in this direction. From the nature of the fungous diseases developing upon slash it is evident that there are only two practical means of disposal; the one, destruction by fire, and the other, the checking of fungous development by dessication. In regions where the methods of cutting and the climatic conditions are such as to favor leaving the infected slash exposed to the air and sunlight, it might be feasible to try control by this method, stacking the infected material in such a way as to allow the free circulation of air and the maximum of sunlight, or stripping portions of the bark so as to hasten the drying out process. This could only be done, however, where conditions were such as to thoroughly dry out the host material and in this manner kill the fungus within. The moisture conditions on many of the logging operations conducted in the Northwest region do not favor such a method, and destruction by fire is apparently the only alternative. Humphrey,¹² in a study of timber storage conditions, recommends burning of all infected debris in lumber yards where timber is stored, as the only practical and efficient sanitary method. Meinecke¹⁶ also proposes fire as the best method to rid the forest of fungous fruiting bodies. This method, when practicable, is of course, the best one to use.

Assuming always that the proper application of pathological marking rules³⁵ to the area has resulted in the cutting of all the most dangerous infected trees, the cut-over area next presents the problem of the best and cheapest method of disposal of the resulting infected slash.

If the object of forest hygiene is constantly kept in mind by the forest officer in charge of the sale area, he can so direct the piling of brush that when it is burned a considerable amount, if not the majority, of the infected slash will also be burned. Slash piles can be made with culled infected sections, infected stumps, snags, windfalls, etc., as centers and other piles can be constructed at the bases of such standing trees as it is desired to kill or destroy by fire. This process is, of course, limited by the amount of available brush on the area, and whether or not undesirable, inferior trees are present. Upon such areas where the majority of brush is utilized in killing trees of inferior species and a large amount of the infected slash is left undis-

posed, some other method must be found to prevent, or at least check, the development of sporophores upon the down material.

References cited and data given in the text indicate that a partial solution, at least, lies in the possibilities of checking the fungus by desiccation. To this end a free circulation of air about the culled section, a minimum of shade and of contact with the soil and soil moisture, must be maintained. This is best accomplished by a loose stacking of the infected material in the most open spots. The stacking should allow free circulation of air and admission of sunlight. On open and dry slopes, where the moisture conditions are unfavorable to fungous development, the infected slash can be left in place. Green infected slash is best handled by stacking, since its green condition would present difficulties in an attempt to destroy by fire, especially if the amount of available brush is small. Usually the brush is not burned until some time has elapsed after cutting and a certain amount of the water in the log has evaporated. To counterbalance the greenness of the infected slash, such factors as the dry, inflammable bark off older trees, resin exudations and the resin content of the wood and bark, are to be considered.

Agricultural land or areas in creek bottoms and draws which are clean-cut are nearly always cleaned up after logging, by broadcast burning accompanied by suitable fire lines. Such areas, owing to this forest policy, are automatically made hygienic to a high degree, in respect to forest pathology, and need be considered no further.

It would be well to discuss here the application of slash disposal methods to the most important forest types of the region in which timber sales are being conducted. The types in which sales are most frequent are the western white pine, larch-fir, spruce, lodgepole and western yellow pine. Of these the western white pine, larch-fir and spruce types are sufficiently alike in respect to the moisture conditions of the sites upon which they occur to be grouped together. The lodgepole and western yellow pine types likewise are somewhat similar in this respect, and can be considered as a separate group. Due to the moist and shaded sites, the environmental factors present upon the first group mentioned are favorable to the development of fungous fruiting bodies, and the inferior species, western hemlock and grand fir, are present in the various mixtures. Also much infected slash is usually left upon the sale areas after logging, due to a large amount of rot present prior to cutting. A majority of the brush will in most cases be used where there is much hemlock and grand fir, in getting

rid of the undesirable trees,^a and this will leave little or none for use in disposing of the remaining infected slash.

Young trees left upon an area following an improvement cutting are open to infection by spores liberated from the sporophores produced on the slash on the area, the standing trees at the edge of the cutting and the trees forming the denser forest surrounding the area. There is greater danger of infection from the first two sources than from the last. This is due in part to the forest itself, which acts as a screen, preventing the wide distribution of spores liberated within the denser stand, and to the freer circulation and greater dispersion of the spores produced in the more open stand of the cut-over area.

In the young growing stands, A_1 and A_2 , of the western white pine type,¹⁵ where improvement cuttings are proposed by the Forest Service, there is a maximum need for forest sanitation. This is due to the danger of infection to which the young trees of the future crop are subjected. In such areas every means possible consistent with economic conditions should be employed to destroy or prevent from developing, all sporophores of the more harmful, wood-destroying fungi.

In mature stands,¹⁵ B_1 , B_2 , and B_3 , where reproduction cuttings or clean-cutting methods are proposed, and where the only trees left upon the area are seed trees, the greatest danger to the reproduction is from mistletoe,^{28 29} and rust infections. The removal of all mistletoe, rust-infected and otherwise diseased standing trees upon the sale area should be provided for in the special marking rules.³⁵ This would greatly reduce the danger to the reproduction. The danger from such fungi as *Armillaria mellea*, which attacks seedlings and young trees, should not be overlooked, and such attacks prevented, if possible, by the burning or thorough drying of infected material on the area, such as infected stumps or butt logs. The importance of the disposal of infected slash in the mature stand is not so great as in the young growing stands,¹⁵ since between 50 and 60 years (in the case of heart-rotting fungi in western white pine) would elapse before the reproduction on the area reached the age of earliest infection.³² The diseases would be carried over this period of years more readily by the trees in the surrounding infected stand than by the infected slash left upon the cut-over area. At the same time consideration must be

^a This practice not only covers the removal of undesirable species but in most cases removes trees heavily infected with fungi and also makes light available for the relatively intolerant seedlings of such species as western white pine and western larch.

given the fact that the spread of infection from the slash to the surrounding stand would have some bearing upon the intensity of the diseases present in the surrounding stand when the reproduction reaches its infection age. The cutting of low stumps is desirable from the viewpoint of leaving as little infected material on the area as possible, and the burning of infected stumps by constructing piles over them whenever possible is good forest hygiene.

Close utilization of forest products in many cases aids in leaving a minimum of infected material on the area after logging. The close utilization of the infected portions of western red cedar (especially the butt logs) for fence posts and shingle bolts, as practiced by the Forest Service, leaves very little of this material for fruiting bodies to develop upon. The utilization of cull butts of western larch and other species for fuel in the camps and in the engines of the logging trains, donkeys, skidders, etc., also greatly aids in cleaning up the logging area of infected material. Special sales for cordwood and other products are negotiated by the forest officer after the area has been logged over. This removes snags, cull butts and windfalls, and among these many are utilized which were rejected in the logging operation on account of heart-rot.

The second group, composed of the lodgepole and western yellow pine types, is found to favor the development of fungi to a lesser degree than the first group. This is due to the more open, drier sites upon which the tree species composing it are found. No inferior species comparable to the undesirable hemlock and grand fir are to be encountered in these types, and, in the case of lodgepole pine sales, a closer utilization of the products of logging, particularly in the Deerlodge National Forest, leaves less slash upon the area. On certain sales in open stands and on comparatively dry sites where the brush is to be lopped and scattered, the infected slash could safely be left in position, and no special attempt made for its removal. This is particularly true for south and southwest exposures.

In all cases where disposal of the infected material is planned, such material infected by the most dangerous fungi should be disposed of first. Such sound culled material as crook, wind shake, lightning and frost crack injury, broken parts of the trunk, resinated and swelled butts, etc., do not present the need for disposal to as great an extent as do all forms of infected slash. The infected material, if left in moist shaded situations and not disposed of, will produce sporophores and form an infection menace, while the chances for the sound slash to become infected by the more harmful wood-

destroying fungi and produce sporophores at an early date, are small. If moisture and shade conditions remain favorable, the sound slash may in time become infected and form a menace to the surrounding trees. But in most cases this infection is from purely saprophytic fungi, which do not ordinarily threaten living trees. *Fomes pini-cola* is of this type, but is found acting occasionally as a heartwood fungus and attacking the heartwood of living trees.

In view of the preceding discussion the following suggestion is made to apply to timber sales in both groups where there is danger that sporophores of harmful fungi forming a menace to the future timber crop, will be produced upon infected slash left on the sale area after logging. To arrange the piling and burning of available brush in such a manner as to ensure the effective burning up or charring of a maximum of the infected slash left upon the area, and to place the remaining infected slash in the best position for thorough drying.

SUMMARY.

Certain factors are found to be concerned in the production of sporophores of wood-destroying fungi. The most important ones are: Available water and food supply, resistance of the host to sporophore production, temperature, atmospheric moisture, light, and gravity.

The sporophore of heart-rotting fungi is greatly dependent upon the water and food supply. If the food supply be abundant and the water supply inadequate, the fungus dies, and if the food supply be exhausted a natural death results. Dry situations are unfavorable to fungous development, and to sporophore production.

The living host tissues in certain cases resist the production of sporophores. This factor does not enter in considering down infected slash, and sporophores may develop more readily on such material.

Light is needed in the case of many fungi to stimulate the formation of fruiting bodies, and gravity causes the sporophores to assume the most advantageous positions for spore dispersal. Sporophores produced upon a standing tree and remaining alive will readjust themselves to any new position and produce spores whenever the tree is felled to the ground.

It is found that all of the most destructive wood-rotting fungi operating in the forests of the Northwest develop fruiting bodies on their hosts after the tree is cut.

The field data presented indicate that large numbers of sporophores of various fungi are found developing upon infected slash left upon

cut-over areas. These sporophores produce innumerable spores annually so long as they continue alive, and are grave sources of infection to the remaining susceptible trees of the stand. This danger threatens seed trees, reproduction and all surrounding mature trees. The more moist and shadier sale areas recorded are found to develop a larger percentage of live sporophores than the drier and more open one, and logs in close contact with the ground develop sporophores more readily than logs raised above the ground and receiving less moisture.

A high percentage of live sporophores, as well as of new sporophores formed since the cutting, is found on all of the areas recorded. *Trametes pini* fruiting bodies are found to be more numerous than those of other species of fungi, and have a high percentage alive. All manner of slash (excepting brush) is found bearing fruiting bodies. Slash left upon sale areas acts as a fire menace and as a disease-infection menace. It is, therefore, highly desirable to dispose of all such material in order to improve the health of the forest.

Suggestions are made for the disposal of infected slash left upon cut-over areas by means of piling and burning of brush and stacking of remaining infected material so as to prevent sporophore production. These suggestions are adapted to the various forest types according to the moisture conditions of the sites, the cutting methods used, the presence of undesirable inferior species, and the available brush.

This study agrees with the timber sale policy of the Forest Service in regard to forest sanitation and hygiene as practiced in the forests of the Northwest, and tends to emphasize the necessity of protecting the future timber crop from its numerous diseases.

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NOTES ON THE PARANA PINE OF SOUTHERN BRAZIL

BY LAURENCE LEE, B.A., M.F.

With the war over and reconstruction going on in Europe, the question of supply of material becomes more important as the demands on the other side increase. Lumbermen of the United States have long ago formed their plans and are pretty certain of their ability to cope with the situation. However, as ships are released from transport duty and are turned into trade channels, competitors are likely to step into the limelight from parts heretofore not regarded as very important.

In the plateau region of southern Brazil are vast forests of a timber tree known as Parana pine (*Araucaria brasiliensis*). Some of the largest tracts are located in the State of Parana; hence the trade name, Parana pine. According to figures, ". . . in Parana one company claims ownership of connected forest tracts of Parana pine, a large part of which is in primitive state, aggregating three billion feet and averaging about 4,000 feet per acre. Assuming that the estimate of an area of 260 million acres for the region is correct, divide this area by two to make a liberal allowance for non-merchantable forests, clearings, etc., there will remain 130 million acres covered with merchantable forest. At 5,000 board feet per acre, this will give a total of 650 billion feet. It is believed that this estimate is very conservative. At any rate, for all practical purposes it is sufficiently accurate."¹

This would seem to indicate a quantity worth reckoning, particularly in view of the fact that Parana pine in the better grades can be used for about the same purposes as our southern yellow pine, and in the poorer for the same purposes as our white pine.

I have recently returned from an eight months' trip through Brazil in connection with commercial investigations of a large New York exporting house, and have seen some of the conditions of the present commercial situation there. Since my return, there has come to my attention a prospectus gotten out by the largest lumber company of the Parana pine region, and in translating it from the Portuguese, several interesting features were noted.

It should be kept in mind at the outset that the statements and

¹ Whitford, H. N. "Tropical Forests and the War." JOURNAL OF FORESTRY, Vol. XVI, p. 515.

figures presented in the prospectus are advanced by a lumber company whose chief product is Parana pine and furnished by the manager of one of the large sawmills in the State of Parana, so there should be a slight tendency to overestimate.

In the first part of the prospectus a comparison is made between Parana pine and Swedish red and white pine from figures obtained by a number of tests on the physical qualities of Parana pine carried on in the laboratories of the Belgian Government Railways under the supervision of the Dyle Company of Louvain. The experiments were made on several pieces of wood representative of the general character of the timber, the size of the pieces being .10m x .10m, with a meter span between the points of support. As a result of these tests, the following table is given in the prospectus as showing the superiority of Parana pine over the European timber:

Wood	Specific gravity per cu dm.	Modulus of rupture per sq. cm. <i>Kilos</i>	Elastic limit per sq. cm. <i>Kilos</i>	Breaking load per sq. cm. <i>Kilos</i>
Parana pine	0.865	6.8	2.20	2.10
Swedish red pine.....	0.586	4.6	3.50	1.75
Swedish white pine..	0.470	4.3	3.10	1.55
Tapinha ²	0.946	8.7	7.00	3.50
Imbaya ²	1.029	6.3	5.30	2.65

² Native Brazilian hardwoods.

The promoters claim that the above figures establish the superiority of Parana pine over "pitch pine" (undoubtedly our southern longleaf), as well as over the European timber. Whether or not these figures are strictly accurate, they at least provide some basis for judging a new and potentially important wood.

In order to secure original data to serve as a basis for comparison, the writer made tests, under the direction of Professor S. J. Record, of the Yale School of Forestry, on representative pieces of Parana pine. The specimens used in the tests were taken from laboratory samples which had been thoroughly air-dried. These samples were as follows:

<i>Specimen No.</i>	<i>Description.</i>
I, Ia, II, and IIa.	Sapwood. White, light and very like our white pine.
III and IIIa....	Heartwood, near the sap. Generally brown with generous streakings of red.
IV	Heartwood. Generally reddish, with some brown.
V and Va.....	Center heartwood. All brown with no red.
VI and VIa. VII.	Center heartwood. Mostly brown with slight tinges of red.

In considering the anatomical structure and function, it has been found that:

1. No resin ducts have been encountered.
2. When cut, no resinous exudations occur as in our pines, but that around the base of the knots there seems to collect a generous portion.

The following tables are the results of the tests made by the writer:

TABLE 1.

[Based on oven dry measurements.]

Specimen number.	Air dry weight. <i>Grams</i>	Oven dry weight. <i>Grams</i>	Moisture content. <i>Per cent</i>	Weight of water displaced. <i>Grams</i>	Specific gravity.
I	20.0	18.7	0.068	37.0	0.506
II	16.3	15.2	0.072	32.0	0.475
III	61.3	56.7	0.081	96.0	0.590
IV	56.5	51.5	0.096	99.0	0.520
V	64.6	59.5	0.085	105.0	0.566
VI	69.3	63.9	0.084	117.0	0.546
VII	177.7	163.9	0.084	299.0	0.548
Averages	....	....	0.081	....	0.534

TABLE 2.

[Based on air dry measurements.]

Specimen number.	Air dry weight. <i>Grams</i>	Wt. of water displaced. <i>Grams</i>	Specific gravity.
Ia	11.5	23.0	.500
IIa	17.5	34.0	.514
IIIa	54.0	90.0	.600
Va	41.5	79.0	.525
VIa	50.9	88.0	.578
Averages	....	....	.543

In comparing these results with those given in the table taken from the prospectus, it will be seen that the specific gravity obtained by the writer is considerably lower than that of the prospectus. However, available figures from tests made both in the United States and South America place the specific gravity of Parana pine at between .500 and .600, so that the results obtained by the writer check more closely than do the figures of the prospectus.

Taking up now a discussion of the rest of the prospectus, it appears that it was not until the latter part of the nineteenth century, about 1886, that the timber of Parana pine came to be noticed outside of a limited market. All the early attempts to introduce it on the markets of Rio de Janeiro and Sao Paulo were failures because, quoting from

the translation of the prospectus ". . . of the difficulties of transportation of the products to Antonina (a small port on the coast of the State of Parana). Transportation costs absorbed large sums, making the business of exportation impractical." With the opening of a railway in 1887 from Paranagua, an important port in the State of Parana, to Curitiba, an interior town in the heart of the pine region, the question of the exportation of Parana pine again became one of note. In that year two steam sawmills were set up at a place along this railroad. These mills were equipped to turn out a daily production for the two of approximately 60,000 feet board measure. It was the intention of the operators of these mills to introduce the Parana pine into the markets of Rio de Janeiro, Sao Paulo and Rio Grande do Sul in Brazil, and the River Plate region further south. The annual consumption for these markets was estimated to be the equivalent of \$1,620,000, U. S. currency. Hitherto these markets had been supplied by timber from the United States and Europe, and the importers, particularly in Rio de Janeiro, resented and fought fiercely the introduction of this new timber, although it was claimed shipments could be made at a much lower rate than the foreign product.

In the year 1892 the consignments of Parana pine for construction purposes to Sao Paulo amounted to about \$162,000, U. S. currency, and during the period from January, 1896, to June, 1899, the consignments to Rio de Janeiro and Sao Paulo amounted to an equivalent of \$282,416, from which the State of Parana collected a revenue tax of \$11,916. This does not seem like a very large increase over the 1892 production for Sao Paulo and is probably due in part to the strong opposition met in the markets of Rio de Janeiro from the promoters of foreign pine.

In the State of Parana at the present time it is estimated that there are over 100 sawmills engaged in manufacturing lumber of various sizes from Parana pine, but considering the number of mills, the output is startlingly low and the reason seems to lie in the question of transportation.

Since transportation plays such an important part, and yet is so woefully lacking, though promises to improve, it might be well to discuss the situation, particularly with reference to this region. Rail transport is as yet impossible for all practical purposes due both to the high rates and uncertainty of movement. Water transport is not much better. The ports of Paranagua and Antonina, in the State of Parana, are the chief ports for the exportation of Parana pine lumber. Both are touched but by very few ships, and practically the only steamers are

the small coastwise vessels of the Lage Brothers, of Rio, a native private company, or the smaller ships of the Lloyd Brasileiro, a Government concern. Larger ships than 5,000 tons with more than 15 feet depth of draught cannot enter these ports because of the shallow bays in which they are situated. Channels have been dredged, but the constant shifting of the sand necessitates almost continuous attention. With such small vessels the cargo space is of necessity very limited, and is usually taken up with the more staple form of products, such as coffee, oils, cotton, sugar, etc., so that when a consignment of lumber is to be shipped it has to be taken in several shipments in small deck loads at a time. This not only increases the freight charges, but it also means that a large consignment will come dribbling into the market for several months before the entire lot is moved. The writer had the opportunity of seeing an actual case of this in May, 1918. We were on our way from Santos to Porto Alegre on board the S.S. Itauba, one of the Lage boats, and spent a day in the harbors of Paranagua and Anotnina. Our ship was already fairly well loaded, and at both places there were consignments of Parana pine lumber waiting. Some of each consignment was placed on the forward deck, but the bulk had to be left behind through lack of room. The conditions of cargo space on sailing vessels, which call more or less frequently, are much the same as for the steamers.

Another feature that has held back the development of this valuable timber is that of the State export tax, one of the "most iniquitous" of the Brazilian tax laws. Every article of produce sent out of a State is taxed by the State, no matter if it only goes over the line into the bordering State. With some products it is not so important, but with lumber it is a very serious matter. Imagine, if you can, California taxing a shipment of douglas fir bound for Nevada! Yet this is an actual fact in Brazil, and one cause for the lack of advancement of the nation.

With these two features, high cost of transportation and unfair taxes, it is no wonder that Parana pine has not long ago come into its own and demanded the respect of lumbermen in the United States as a possible competitor in South America and abroad. Improved conditions in shipping are already pretty well under way, but the tax laws are in the hands of the Brazilian Government, and—"quien sabe!"

REVIEWS

Report of the Department of Forestry of the State of Pennsylvania for the year 1916-1917.

This report, which reaches us rather belated, is throughout concerned with the business of administration, the bulk being occupied by tabulations and lists of officials. By additional purchases the total area of public forests was brought up to 1,017,773 acres, which is divided into 52 State Forests, each one under the administration of a Forester, except for the necessity of curtailment during the war. Altogether the department employed 71 foresters and 80 forest rangers, besides in the neighborhood of 1,400 to 1,800 fire wardens for the 21 districts into which the State has been divided for protective purposes. The organization for this latter purpose seems now to be complete with 47 observation towers, 174 other observation points and nearly 300 miles of telephone line. Still, in 1917, over 2,000 fires damaged over 300,000 acres by over \$600,000, causing over \$30,000 of expenditure for extinction. In State Forests alone a gratifying reduction of area burned is notable during the three years, 1915, 1916, and 1917. The recreation feature of the State Forests is brought out by the fact that 400 camp leases were granted, the fee charged running from \$5 to \$20. Revenues from timber sales are still nominal. The total receipts of the State Forests amount to a little over \$21,000 and the expenditures in the neighborhood of \$180,000.

State nurseries to the number of four occupy 29 acres, besides 19 small nurseries maintained largely for their educational value. These nurseries have shipped some 4,000,000 to 6,000,000 plants per year and could increase their production to 15,000,000 but for the danger of reforestation operations running far in advance of protection work. This consideration has to some extent checked the extensive planting operations of the State. Free distribution of seedlings, the applicant paying cost of packing and hauling (20 cents to 40 cents per thousand), is practiced, *not fewer* than 500 seedlings to one order. Close to one and a half million seedlings were privately planted in 1916, while the State planted five and a half million on 4,106 acres at an average cost of \$6.19 per acre and \$3.05 per thousand. In 1917 the private planting was somewhat increased, the State planting decreased at increased cost, namely, \$7.91 per acre and \$3.73 per thousand. Since the State

planting was begun, in 1899, around 25 million plants were set out on 15,459 acres, the cost per acre varying between \$6.10 and \$34.58 per acre, averaging \$3.58 per thousand. Details of all operations are given in tables.

There is a singular absence of discussion of a broader, progressive forest policy for the State, which may perhaps be explained by the overshadowing presence of the specter of war stopping all thought of economic development. Perhaps the recent appointment of Mr. Gifford Pinchot to the commission, under which the department functions, will help to adding the progressive element, especially as the Governor is said to favor more vigorous action.

B. E. F.

A Study of the Rots of Western White Pine. By J. R. Weir and E. E. Hubert. U. S. Dept. Agr., Bul. 799: 1-24. 1919.

It is estimated that the stand of western white pine in British Columbia, Oregon, Washington, Idaho, and Montana is about 23,685 million board measure, valued at about \$102,875,000. The average amount of rotten wood present is found to be about 7 per cent, according to these studies, or 1,658 million feet, giving a loss of about \$1,201,250.

These studies are based on the observation of about 1,400 trees during logging operations on seven sale areas, mostly in the Coeur d'Alene region of Idaho.

Three fungi were found to be principally concerned; *Trametes pini* producing rot in all parts of the tree, *Polyporus schweinitzii* and *Fomes annosus* producing butt rot.

Age was found to be a prominent factor in determining the amount and stage of decay. The age of earliest infection was found to be approximately 50 years. For all age classes the number of infected trees and the amount of rot increased steadily with the age due to the increase in dead branches, frost cracks and other opportunities for infection.

The bottom sites were found to be a little more favorable to the development of rot than the slope sites.

The maximum production of sporophores is found to occur in the 121 to 160 age class. The 101 to 120 age class presents, in so far as the rot data shows, favorable figures upon which to determine a pathological felling age.

For control, proper pathological marking rules and practical methods for the disposal of infected slash are recommended.

K. F.

The Kiln Drying of Jarrah. By C. E. Lane-Poole, Conservator of Forests, Western Australia. Bulletin No. 1, Forests Department of Western Australia. 1919. Pp. 28.

Jarrah, a species of eucalyptus, is one of the leading timbers of Western Australia. It is used not only for rough construction of all sorts, but also for high-class work, such as furniture and cabinets. Heretofore jarrah lumber was air dried only, with the result that the timber depreciated considerably, and often was not sufficiently dry when remanufactured. In fact, much stock thicker than one inch is imported because native woods are not properly seasoned. The increased demand for lumber, and the increased cost of long-time air drying, together with its deficiencies, prompted the Forests Department to experiment in the kiln drying jarrah.

Three Tiemann water-spray kilns are being used for the experiments. One of these kilns, of experimental size, was first erected at a commercial plant, and later two other somewhat larger kilns were built on the grounds of the University of Western Australia at Perth. These kilns are of typical design, except that in one the spray water is heated by passing it through a steam jacket instead of in a well and that condensing coils are not shown in the illustrations or mentioned in the text. The inclined method of piling was used, a space being left between the edges of the boards.

Green one-inch jarrah, with a moisture content of 55 to 86 per cent was satisfactorily dried to 12 per cent moisture in twenty days. Apparently this was as low a moisture content as was desired, although the purpose for which the lumber was to be used is not given.

Sample pieces were weighed from time to time to determine the rate of drying and disks were cut every few days to test for case hardening. At the end of the run the lumber was steamed to remove any set in the surface layers. By using "safe" temperatures and humidities no particular difficulties seem to have been encountered. The author recommends a temperature of 105 degrees F. and a humidity of 86 per cent to begin with. The temperature is then gradually raised within the piles but the baffle plate temperature is kept constant so as to simplify the operation. No ill effects resulted in using temperatures up to 150 degrees F., but at higher temperatures jarrah is very subject to severe end checking and, still worse, collapse. A psychrometric chart, working somewhat on the principle of a slide rule, is included in the bulletin. By placing a straight-edge so that it coincides with the dry-bulb temperature and with the baffle plate, or saturation temperature,

each on a separate line, the relative humidity is indicated at the point where the edge crosses a third line.

The author very fittingly states that grading rules for lumber should contain specifications for moisture content and amount of case hardening permitted. These conditions, he points out, are far more important in lumber utilization than some of the comparatively insignificant details concerning knots, checks, wane, etc., usually mentioned in grading rules. He even suggests that the Forests Department might inspect lumber for moisture content and case hardening and issue a certificate of inspection.

A debt of gratitude to timber physicists for their researches is expressed, special mention being made of Mr. Tieman and the Forest Products Laboratory.

A. K.

Report of the Forester, Fiscal Year Ended June 30, 1919 By Henry S. Graves, Forester, U. S. Department of Agriculture.

The noteworthy achievement of the Forest Service during the war was the co-operative work undertaken chiefly by the Forest Products Laboratory at Madison, Wisconsin. Valuable co-operative assistance was given the Navy and War Departments and private industries in the solution of problems connected with airplane construction, artillery wheels, ship building, charcoal, and especially in the rapid kiln drying of all kinds of wood so urgently required for the war. All the more credit is due the Forest Service when it is realized that many of its officials had enlisted for active service. Moreover, much of this work was done by patriotic young men who received less salary than the ordinary munitions worker, and probably less than half the salary that is today paid to skilled mechanics. Since the armistice, it must have been no slight task to unscramble the organization that had been welded together for war work. The European countries had made the blunder of using up many technical experts simply because they were young enough for "cannon fodder" and because these young men refused to stomach the idea of remaining at home while older men were being killed. Modern warfare demands heroism, but most of all technical skill, and unquestionably the Forest Service followed the right policy by refusing to allow its research experts to enlist.

Colonel Graves officially announces "a new movement for extending the practice of forestry," and speaks of forestry as having become "something which a business man could grasp and weigh on its merits as a definite business proposal," yet in the same report (page 5), under

the heading "Receipts and Operative Expenses," nothing could be found in the text referring to operating expenses, nor is there anything in the report particularly interesting from a business man's viewpoint. Moreover it is clear from the discussion under "Forest Investigations" (page 33) that the lack of business yield data for forests is keenly felt. But it is unquestionably true that the National Forest expenditures are fully warranted by the fire protection, range control, and to preserve and administer the areas suitable for camping and recreation; if the National Forest administration cost three or four times what it does at present it is worth the money. It is well known in the West that it is those who want something for nothing who would vote for a return to the old unregulated forest plundering. But, nevertheless, the best way to convince the private forest owner to practice forestry is to show him that forestry pays; if it doesn't pay in money, should not the public buy and administer much more private land than it has at present? We always have the teachings of forest history to guide us. We have learned from Europe that solely from the financial standpoint *forest production over a number of years does not usually pay*. There are exceptions; but the profits are usually due to abnormal conditions. If you can buy cheap and sell at a higher market, well and good, but suppose that the market decreases as was the case with European fuel producing stands in the last century, then there is a corresponding loss. Eliminating this speculative factor, forest production does not pay more than 2 to 5 per cent, while today sound bonds pay 6 to 7 per cent, with no worry or danger of loss. What is the answer? *Public ownership!* when the State can point to a balance sheet enriched by indirect forest values and benefits.

It is a pity that Congress has not promptly authorized the additions proposed for National Forests in Wyoming and Idaho, and certainly there should be more money for fire protection when it is considered that more than a million and a half acres has been burned during the fire season in 1919. For more efficient fire protection, Colonel Graves asks for additional roads and trails, a larger protective force, motor transport, more public co-operation. He summarizes its needs as follows:

- (1) The Forests have not yet been sufficiently opened up with roads and trails. It is still necessary in many cases to build trails through the woods to the fires. This may require several days, during which a fire may have become a great conflagration.

- (2) The regular protective force is insufficient.

- (3) The Forest Service is almost wholly unequipped with motor transport. Aside from the fact that the cost of hiring trucks to transport men and supplies

for fire fighting is very large, the difficulty of obtaining such transportation sometimes results in failure to reach a fire before it is too late. Adequate equipment with motor trucks would save a great many thousand dollars each year.

(4) Successful fire protection is absolutely dependent on a permanent force of trained men. Without that, fires which should be put out promptly with little loss or cost spread widely and require many thousands of dollars to prevent disaster, let alone extinguish them.

(5) Public sentiment in many places has not yet been roused to the need of care in the forest and public co-operation. There are still too many smoking, and too many fires from clearing land.

The answer to the forest fire problem is, therefore, more roads and trails, sufficient salaries for our forest officers to enable the building up and holding of a well-trained force, greater leeway in furnishing motor equipment for fighting fires which could also be used in road improvements, and a more vigorous campaign to educate the public to better co-operation in fire protection.

The timber cut on National Forests amounted to 705,753,000 feet board measure, worth slightly more than 1.5 million dollars; the timber sold was 799,476,000 feet board measure, worth over 1.8 million dollars. As Colonel Graves points out, the reason that more timber sales are not made is because most of the virgin timber is inaccessible and cannot be placed on the market. The best that can be done under present legislation is to interest our large operators and sell on long-term contracts. The main disadvantage is that this places the bulk of the timber in the hands of a few, whereas the ideal would be to have a larger number of purchasers. The policy adopted by most other nations has been to assume the task of exploiting, or at least of developing, transport so that the small man can bid on small size scales. *It would certainly be more profitable if the Forest Service could be authorized by law to build roads and railroads to tap the virgin timber that is now going to waste for lack of transportation.* It is interesting to know that 150 acres (out of 154 million acres) has been sown and 6,761 acres planted.

The grazing fees have at last been increased and the revenue from this source is now 2.6 million dollars. But with the need for water power in the West it is surprising that the receipts from this source were only \$72,322 and that only ten preliminary new applications were received during the past fiscal year. Unquestionably the road work improvement must be speeded up. This will come after the war, but with 154 million acres of National Forests the road work should be counted by thousands of miles instead of by hundreds. According to the report:

The new construction of improvements of all kinds comprised 328 miles of roads, 833 miles of trails, 885 miles of telephone lines, 78 miles of fire lines, 35 lookout structures, 35 bridges, 284 miles fences, 510 dwellings, barns, and other buildings, 12 corrals, and 202 water improvements. The above figures include 203 miles of roads, 96 miles of trails, 110 miles of telephone lines, 148 miles of stock fences, 6 miles of fire lines, 1 bridge, and 1 water improvement built in co-operation with communities, associations, and individuals.

Excellent progress seems to have been made in co-operative State fire protection during the past fiscal year; \$725,366 was expended in 28 States. It is surprising, however, that every State in the Union with forest wealth has not got into line and entered into co-operative agreements for forest fire prevention.

The report follows the usual order, but, as formerly has no summary or table of contents.

T. S. W., JR.

Report of the Forest Administration of the Central Provinces, 1917-18. 96 pp. Nagpur, British India, 1919. The usual annual report with detailed tabular statements appended.

The Chief Conservator served as a member of the Committee of Control of the Tannin Research Factory at Maihar. A start had been made with the systematic cultivation for tannin purposes of tarwad (*Cassia auriculata*) which has hitherto only grown wild in certain places in the south of the Provinces. Under the influence of the war demand for shellac, the scientific production of lac has also been undertaken and arrangements have been made for propagating it departmentally on a more extensive scale. It is intended that, as soon as one is available, an officer should be placed on special duty to take charge of the operations, which will include the demonstration of improved methods to the lac-growers who lease areas in privately-owned forests.

The total number of animals grazed in the forests during the year fell from 3,581,780 to 3,434,484, and the income declined from Rs 13, 85, 911 to Rs 13, 73, 955, but much of the decrease occurred among sheep and goats, and it is therefore not entirely to be deprecated.

With the return to normal conditions, and the expansion of industrial work, consequent on the Report of the Indian Industrial Commission, there should be largely increased possibilities of exploitation of the State Forests and a fuller utilization of many species of timbers and minor forest products. The further opening up of the forests by improved communications and possibly by means of mechanical trans-

port and the encouragement of local saw mills for conversion of timber to meet all forms of market demands will be necessary, and the early establishment of a research branch to inquire, among other things, into the possibilities of utilizing many forest products at present little or not used, is most essential. The commercial aspect of the forest department cannot fail to become of increasing importance.

Other matters to which attention might profitably be devoted are:

(1) **Improved methods** of cultivation and collection of lac, and extension of propagation of lac to areas where suitable species of trees exist.

(2) **Improved methods of extraction of rusa oil.**

(Both these matters are receiving attention, but a special research staff is needed for the work.)

(3) Extension of bamboo plantations to Berar to meet the local demands.

(4) Replacement of inferior species of trees in poor class forests by more valuable species suitable to the locality. (As an example, may be quoted the promising results obtained by sowing sandal in the Akola Division.)

(5) Best methods of utilizing the myrabolan (*Terminalia chebula*) crop. (This product, which is of the greatest importance in the tanning industry, was largely exported to Germany in pre-war days.)

(6) The commercial possibilities of creating mohwa (*Bassia latifolia*) plantations.

A liberal expenditure and an adequate staff will, however, be essential to ensure progress.

Out of the total area of State forest of 19,640 square miles an area of 16,544 square miles, or 85 per cent, has sanctioned working plans. For an area of 1,548 square miles out of this latter, however, plans are in progress of revision. An area of 1,789 square miles requires revision, for 677 square miles of which it has been undertaken. New plans are being prepared for an area of 545 square miles, while for an area of 57 square miles plans have still to be taken in hand, the area for which no plans are considered to be necessary at present being 2,503 square miles. These are mostly B and C class forests.

In the Southern Circle the sowing of sal under the protection of telia (*Wendlandia exserta*) was continued in the South Raipur Division, but the results are not said to have been very successful, and basket-planting is now being tried. Experiments were in progress in Allapilli to ascertain the best methods of tending teak sowings in blanks, where Anjan seed was also sown with teak. Sowings of *Cinnamomum camphora* were made in frost holes in the Bilaspur Division with a view to protecting the young sal. In Nagpur-Wardha observations were in progress as to the mortality of bijasal seedlings and methods to counteract it.

The 1,507 acres at the close of the year of the regular plantations were composed of 242 acres of bamboos, 385 teak, 505 sandal, 16 chir pine, 10 sal, and 349 tarwad.

Taungya Plantations.—These occur in the Berar Circle only. To the 6,411 acres at the beginning of the year 569 acres (389 babul and 180 miscellaneous) were added during the year, and 256 acres of babul and 140 acres of mixed forests, all in the Amraoti Division, were excluded, thus the total area under these plantations, at the close of the year amounted to 6,584 acres. In the Yeotmal Division 180 acres were resown with teak seed, but though the germination was good, very few seedlings survived the hot weather.

Coppice with Standards.—68,679 acres was exploited under this system against 62,037 acres in the last year. The increase of 6,642 acres was spread over all the Circles (Northern Circle, 3,961 acres; Southern Circle, 2,198 acres, and Berar Circle, 483 acres). The increase in the Northern Circle occurred mainly in the North Mandla Division where certain areas were provisionally opened for fellings. In the Southern Circle there has been a steady increase under this head during the last four years, the figures being 36,982, 38,282, 42,118, and 44,316 acres.

Tests as to the mechanical strength of the Allapilli teak indicated that it differed but little from the Burma teak, the later having a slight advantage in transverse strength and the former in shearing and compression strains. Chanda teak is said to work to a smoother finish and presents a more ornamental appearance for furniture and panel work.

Twenty new forest villages were established and two were deserted. The villages newly established in the Seoni Division were of great assistance in supplying labor for felling and carting contractors' produce and also in the construction and repair of forest roads. The difficulty in obtaining villagers prevent the establishment of several villages sanctioned.

E. R. H.

Effect of Varying Certain Cooking Conditions in the Production of Sulphite Pulp from Spruce. By S. E. Lunak. Bulletin 620, U. S. Department of Agriculture, contribution from the Forest Service. Washington, D. C., March 14, 1918. Pp. 24.

The bulletin discusses the results of three series of cooks made by the sulphite process, in which the following variables were studied:

The amount of combined SO_2 , total SO_2 being constant, total SO_2 ratio combined to free SO_2 being constant; temperature.

The conclusions drawn are briefly as follows: 1 per cent combined SO_2 is the smallest amount possible with good results. Increasing amounts of combined SO_2 seem to increase uniformity of cooking, but decrease the speed.

Five per cent total SO_2 seems to be the lowest amount of total SO_2 consistent with good results. The higher the SO_2 the easier the bleaching of the pulp. The lower the temperature the more uniform the cooking and the easier the bleaching.

While data for only twenty cooks are given they represent the results of ten years' of pioneer work in the design and operation of pulping apparatus on a semi-commercial scale, and the fact that this is the first publication of investigating work on cooking by the sulphite process, in which definite indications of a quantitative nature are given reflects great credit to the author and the organization which he represents. It is hoped that the work will be continued and the effect of the other cooking variables in this process, such as the ratio of magnesium and calcium in the cooking acid, rate of gassing, etc., be determined and published for the benefit of the industry.

S. D. W.

Progress Report on Wood-Block Paving Experiments in Minneapolis. By C. H. Teesdale and J. D. MacLean. In Proceedings of the fifteenth annual meeting of the American Wood Preservers' Association. 1919. Pp. 124-133.

This experimental piece of treated wood-block pavement was laid in 1906 in the city of Minneapolis in co-operation with the Forest Service and various lumber manufacturers and wood-preserving companies. Full details of the experiment will be found in Forest Service Circular No. 141. The first progress report was published in 1912 as F. S. Circular No. 194. A further discussion of the tests appeared in the *Municipal Journal*, May 6, 1915.

The main purpose of the experiment was to determine the relative merits of various species of wood for paving material. Study was also made of the influence of certain variables, namely, heartwood and sapwood, length of blocks, and angles of courses.

In the early part of 1911, two sections of Douglas fir blocks were relaid. In one spot, comprising an area of about 30 square feet, the blocks were so badly worn that they were completely shattered into small bits. This failure was attributed to the poor grade of material

used, and further test was made by relaying one of the worn-out sections with a thoroughly good grade (Grade A) of Douglas fir. The remainder was filled with regular yellow pine blocks supplied by the city.

After seven years' service the fir is beginning to wear and broom, and rapid increase in the area of local depressions was noted during the last two years. "While these depressions are not deep at present, the area affected is in marked contrast to the surface of the yellow pine portion laid at the same time."

The results are summarized as follows:

(1) Considering the species in sections 1 to 10, the order of efficiency of service is as follows: (a) Longleaf pine, (b) white birch, (c) eastern hemlock, (d) tamarack, (e) Norway pine, (f) western larch.

(2) Since the relaid Douglas fir has only been in service 7 years, a good comparison of this wood cannot be made with the woods which have been in use for a period of 12 years. At present the depressions and wear of this species are from two to three times as much as that of the longleaf pine portion laid at the same time.

(3) For most of the species the depressions were very slight during the first 4 or 5 years' service. After this period the depressions increased at a very rapid rate.

(4) Sections 12, 13, and 14 showing wearing qualities of Norway pine which compare favorably with longleaf pine and white birch. These sections probably give a better comparison of the durability of this species than does Section 1, which is subjected to unusually severe traffic conditions on account of its shape and location.

(5) The western larch sections have the greatest percentage of area affected by depression. This is also one of the species which shows the heaviest wear.

(6) The order of the species beginning with that showing the least wear is as follows: White birch, longleaf pine, Norway pine, tamarack, eastern hemlock, and western larch.

(7) The presence of sapwood did not seem to be an important factor affecting the durability of the pavement.

(8) The various lengths of blocks employed had no apparent influence on the wearing qualities of the pavement.

(9) Less joint wear was noted in sections laid at 45° and $67\frac{1}{2}^{\circ}$ than in the section of blocks laid at an angle of 90° with the curb.

S. J. R.

Service-Test Records of Treated Cross-Ties on the Burlington Railroad. By J. H. Waterman. In Proceedings of the fifteenth annual meeting of the American Wood Preservers' Association. 1919. Pp. 230-239.

Mr. Waterman, Superintendent of Timber Preservation of the C., B. & Q. R. R., presented some data to the convention and made many

valuable comments of interest to foresters, and which should not be left buried in the official proceedings.

To secure the best results, ties should be cut when the bark is tight, thereby lessening the danger of incipient decay before and during seasoning. Experience has shown that a great many failures of treated ties are due to decayed condition before treatment. The careful and thorough seasoning of ties in the yard of the plant is highly important. The kind of treatment employed should be standard and the best that experience dictates. Poor work, particularly skimping to cheapen the process, means sure loss and dissatisfaction later.

Effective treatment should not stop at the plant, but should extend to the maintenance in track. Heavy tie plates are essential, especially with light rails and the softer woods. The heavier the rail the less the mechanical injury to the tie. Enough anti-creepers should be used to hold the rails in place, the creeping of rails being most serious of course in tracks with one-way traffic only. The road should be well ballasted and well drained.

Test tracks are recommended and suggestions, based on years of experience, are given for the care and inspection of such tracks and the keeping of the records. Not less than 100 ties of a kind should ever be used for a test, and they should be laid "out of face" or all of a kind together. The Burlington has 26,000 test ties marked with nails and paint and the rules forbid anybody touching a tie except in case of wreck or accident, unless it has been previously marked by the proper authority. The division superintendent is held responsible for the test tracks in his division.

Experience on this railroad has shown that the best treatment for ties is straight creosote; second best, Card process (creosote and zinc chloride); third, Burnettizing (zinc chloride).

As to choice of species giving the best results when treated, red oak is ranked first. Over 60 per cent of the red oak ties treated with zinc chloride are still in track in the Black Hills after 18 years' service.

Douglas fir ranks second. The average life untreated is six years. In a mile of treated fir track, 75 per cent have been in 18 years. Tie plates are necessary with fir ties. "I have seen ties on our railroad, fir ties, that were cut half in two in six years when the track right at the side of it with the same kind of tie, the same treatment except tie-plated, was in 16 years."

Cypress, sap not heart, is ranked third. Loblolly pine is satisfactory, but is likely to be rotten before treatment. Mountain pine (lodgepole) has proved serviceable and several miles of track laid with this species have been in 18 years.

Elm, soft maple, hard maple, beech, birch, hickory, red gum, tupelo and other so-called inferior woods will make good ties if cut during the dormant period, seasoned properly and treated thoroughly. Emphasis is laid on the necessity of personal supervision of these ties from the woods to the treating point. A lot of 600 hard maple ties cut in winter, seasoned, treated by Card process, and laid in Nebraska in 1911 are still in perfect condition, and it is estimated that 90 per cent will give 20 years' life and 50 per cent 25 years.

Chestnut is said to give no better results treated than untreated, owing to the fact that it soon wears out when used in the main line, the average life being about six years.

Taking all untreated woods together, birch, beech, chestnut, gum, hemlock, tamarack and others, after 10 years 87.7 had been removed on account of decay and 4.3 per cent for other causes.

S. J. R.

Leakage Resistance of Steel Railway Roadbeds and Its Relation to Electrolysis of Underground Structures. By E. R. Shepard. Technologic Paper No. 127, Bu. of Standards, U. S. Dept. Commerce, Washington, D. C., 1919. Pp. 39.

The object of this paper is to present leakage-resistance data on a number of types of roadbeds for different weather and soil conditions and to discuss the several factors which influence the resistance of roadbeds. Of interest to wood technologists, attention is called to the resistance measurements on treated and untreated wood cross-ties.

From this series of tests it appears that moisture in excess of 20 or 25 per cent has little effect in reducing the electrical resistance of wood, while with less than about 10 per cent of moisture the resistance increases rapidly. Ties embedded in the earth or in paved city streets would probably retain moisture in excess of 20 per cent throughout the year and therefore would not change their resistance materially with seasonal changes. On the other hand, in open construction the moisture content, and therefore the resistance, would vary through wide limits.

For a given moisture content the electrical resistance of chestnut and oak are practically the same, but chestnut wood air dries more rapidly than oak and therefore has a higher resistance for a given time of air seasoning.

"Zinc chloride and other chemical salts used as preservatives render ties highly conducting and greatly increase leakage currents from

tracks. Unless combined with some other material, such as creosote, these salts gradually leach out, particularly in damp climates, and eventually their influence on the resistance of roadbeds disappears." Accordingly the use of these salts for preservatives should be avoided where the escape of stray currents is objectionable or where block signals are used.

Creosoting tends to retain what moisture is within the woods and to retard air-seasoning, but otherwise has little effect upon the electrical resistance. A tie treated by the Card process with one-half pound zinc chloride and two pounds coal-tar creosote per cubic foot exhibited a very low resistance.

A treating material consisting of 75 per cent gas oil and 25 per cent creosote appears to increase materially the resistance of the wood. Open-track construction on which ties treated in this manner were employed had a leakage resistance about twice as great as similar roadbeds with untreated ties and about four times as great as roadbeds with ties treated with chemical salts.

S. J. R.

Forest Products: Their Manufacture and Use. Embracing the principal commercial features in the production, manufacture, and utilization of the most important forest products other than lumber in the United States. By Nelson Courtland Brown. New York. John Wiley & Sons, Inc. 1919. Pp. 471, illustrated with 120 cuts. Price, \$3.75.

This valuable addition to the forester's ready reference library brings together into compact, readable form a vast amount of data about many important industries concerning which information has been scattered and often inaccessible. The author is more than compiler and has put into his work the results of ten years' study at first hand of the various industries treated.

The book comprises 22 chapters. The first is of an introductory nature, covering briefly the extent of our original forests, history of the lumber cut, present forest resources, rate of consumption, annual production of lumber, lumber values, uses of the lumber cut, wastage in production, and converting factors, including those used in the international timber trade, with particular reference to European countries.

Each succeeding chapter is devoted to a single industry, and concludes with a selected bibliography. The sequence of the chapters and the space given to the various subjects are as follows: Wood pulp

and paper (42 pages), tanning material (20), veneers (26), slack cooperage (28), tight cooperage (22), naval stores (24), hardwood distillation (36), softwood distillation (10), charcoal (13), boxes and box shooks (15), cross ties (36), poles and piling (27), posts (4), mine timbers (6), fuelwood (15), shingles and shakes (23), maple syrup and sugar (27), rubber (13), dye woods and material (10), excelsior (9), cork (11).

This book should prove of especial value for reference purposes, being well designed for this use. Each chapter is a unit, and, with the exception of the first, is concerned with a single industry, thus making the subject matter readily available without recourse to the exhaustive index. The presentation is logical and explicit. The work may be considered authoritative, since it is based not only on the author's own investigations and field studies but has also, in large part, been passed upon by various specialists and practical operators.

From this book the reader can learn of the development and importance of each industry, the kinds and source of the raw material, the processes of manufacture, the equipment and operating forces needed, costs of operation, and suggestions for reducing waste. There is also a wealth of statistical data, tables and miscellaneous information. The illustrations are well chosen and add very materially to the clearness of the text.

From the preface one infers that this book was designed primarily as a text for use in the forest schools. The reviewer feels that it does not fully meet the needs of a general text, partly because of its arrangement and more especially because it covers only a portion (a somewhat indeterminate portion) of the field.

The author says: "It is impossible to include in a work of this kind some of the wood-using industries which are closely associated with lumber and its uses, such as furniture industry, shipbuilding and car construction, etc., because they belong in a separate category." The basis for the statement is not entirely clear and one gets the impression that the choice of subjects, as well as their sequence of treatment, was largely arbitrary. As a case in point, what is the reason for including boxes and box shooks in a treatise on "forest products other than lumber?" And why omit handles, matches, spools, etc., and discuss excelsior, which consumes only a third as much wood as handles do?

In the reviewer's opinion, the purpose as a general textbook would have been better served by covering the whole field of indigenous forest products other than lumber. This could have been done in a volume little if any larger than the present one by condensing the material a

little in places, omitting specifications and grading rules, which are constantly subject to change, and leaving strictly foreign products out of detailed consideration. In this way the general subject of forest products would have been divided into two logical parts, one closely associated with lumber, the other concerned primarily with products other than lumber.

S. J. R.

Utilization of Waste Sulphite Liquor. By Dr. Bjarne Johnson and R. W. Hovey. Bul. No. 66, Forestry Branch, Dept. Interior, Canada. Ottawa, 1919. Pp. 195.

At least one-half of the dry weight of the wood used in the manufacture of paper pulp by the sulphite process is contained in the waste liquor and for the most part is discharged from the mills as a useless waste. It accordingly becomes a matter of the first importance to the industry to find practical methods of utilizing these potentially valuable organic products.

The importance of the subject has been recognized and this publication contains the names of 350 persons who have reported officially on it. "But in spite of the large amount of work that has already been carried out in connection with this question and notwithstanding the fact that a few processes for the utilization of waste sulphite liquor have gained industrial importance in some countries, the problem is far from being solved. It cannot be considered to be solved before a process or a combination of processes is established which will utilize all the substances in the liquor so that products will be derived therefrom in an economical way and in a quantity and quality which will enable them to compete with present products on the market."

The object of the compilers of this publication has been to collect all available information and condense it into a form which will be of the greatest usefulness to the industry as well as to those who wish to engage in research in this promising field. The data on this subject are so widely distributed in the literature, and especially in foreign publications which are not readily if at all available here, that the compilers have done a great service in bringing it together in the present volume. The plan has been to cover all of the literature, making the most important abstracts as complete as possible and arranging the information into chapters according to the nature of the recovered products. In the general introduction and the introduction to the more important chapters the situation, the problems and the difficulties are summed up in a very concise and helpful manner.

The headings of the various chapters are as follows: Composition of waste sulphite liquor; effluents; binding material; gums, adhesives, and sizing materials; tanning materials; alcohol; fuel; fodder; fertilizer; dye; sulphur; evaporation; miscellaneous; and general.

"Among the processes for utilization of waste sulphite liquor only a few are of immediate practical interest to Canada. The manufacture of tanning materials is one of these. . . . Canada imports tanning extracts from sulphite liquor, at a price ranging from three-quarters of a cent to one cent a pound, which are used to a large extent in the Canadian tanneries in the preparation of certain leather, chiefly sole leather. The use of sulphite waste liquor as a road and dust binder and a binder for powdered materials such as peat would seem to be of importance to Canada." The manufacture of alcohol is also suggested as possible under certain conditions. "The total production of alcohol from waste sulphite would be about 3,320,000 gallons of absolute alcohol, which would assist in freeing Canada from dependence on foreign sources as well as utilize a waste product."

The facts collected in this bulletin emphasize the importance of the problem, show the wonderful range of possibilities, and disclose that very few of the multitude of proposed processes have attained any industrial importance. It is to be hoped that the research laboratory recently established in Sweden for the purpose of investigation in this field will be able to bridge some of the gaps between theoretical possibilities and commercial practicalities:

S. J. R.

PERIODICAL LITERATURE

SOIL, WATER, AND CLIMATE

After taking issue with A. H. Hutchinson (*Influence of Underlying Rock on Distribution of Jack Pine and Arborvitae* ("Limiting Factors in Relation to Specific Ranges of Tolerance of Forest Trees." *Botanical Gazette*, 66: 465-593, December, 1918) for overlooking the factor of the influence of the underlying rock on the distribution of vegetation, the author proceeds to show the importance of this factor in explaining the "anomalous" distribution of *Thuja occidentalis* and the "irregularities" and "inconsistencies" in the distribution of *Pinus banksiana*. The author explains these peculiarities of distribution in two generalizations according to the chemical nature of the soil, whether acid or basic.

1. *Pinus banksiana* is confined to acid soils.

2. *Thuja occidentalis* is confined mainly to basic soils reaching its maximum development and all of its outlying stations only in positively calcareous areas.

The greater part of the paper is devoted to a discussion of the detailed ranges of the two species and the citation of a copious list of references on the subject. Although *Pinus banksiana*, like other pronounced oxylophytes, is practically eliminated from the vast limestone region to the south and southwest of Hudson Bay, it is frequently found on ridges of acid gravels and sands and it is also sometimes found in acid bogs. The author states that *Thuja occidentalis* is almost as decidedly calcicolous as *Pinus banksiana* is calciphobous. Of the differences of the soil which give special character to the vegetation the presence or absence of lime is regarded as the most important feature in which petrology affects the distribution of plants. The simple grouping of the calcareous and non-calcareous soil-forming rocks helps to emphasize this feature of phytogeology.

Those who do not consider calcareous soils important factors in limiting forest distribution can profit materially by a perusal of this paper.

C. F. K.

Fernald, M. L. *Lithological Factors Limiting the Ranges of Pinus Banksiana and Thuja occidentalis*. *Rhodora*, 21:41-67, March, 1919.

SILVICULTURE, PROTECTION, AND EXTENSION

*Afforestation
in
New Zealand*

W. G. Morrison has presented a very interesting and effective means of securing tree growth in open grass country of New Zealand. The area under discussion is known as the Hanmer Plains, an open, flat country at fairly high elevation, covered with mountain bunch grass. On protected slopes there are a few southern beech found but the general country contains no tree growth. Originally it is believed that there were some other species of trees growing in protected places but they were burned or destroyed by the sheep herders as large bands of sheep are pastured in this region. Heavy forests approach these grass-covered plains on the west and their existence is clearly due to rainfall, there being no trees native to New Zealand capable of growing under such conditions of dryness as are found on Hanmer Plains. In particular the number of rainy days during the year is of prime importance as frequency of rain rather than large amount seems to be the determining factor since evaporation is extremely high due to terrific northwest winds that sweep the area. It is necessary, therefore, that frequent showers should take place. Although no trees native to New Zealand are able to grow and reproduce themselves under these conditions, there are a number of coniferous species native to Europe and North America which are able to thrive here. Some of these exotic conifers were planted around sheep stations 40 to 50 years ago and they have formed nuclei from which a large amount of reproduction is spreading in spite of the drying winds, heavy damage from rabbits, and heavy sheep grazing. Monterey pine (*Pinus radiata*), cluster pine (*Pinus pinaster*), silver birch (*Betula alba*), English oak (*Quercus pedunculata*), European larch (*Larix europea*), and Scots pine (*Pinus sylvestris*) are the chief species represented. All of these, with the exception of the oak, have reproduced heavily as far as 200 yards to the windward, there being from several hundred to a thousand seedlings per acre. The oak has reproduced heavily beneath its crown and a chain or more distant. The cluster pine has, in certain instances, spread as far as two miles to the windward. Monterey pine and Scots pine have been notably successful in spreading. Typically there may be found the old mother 80 feet tall, the offspring which will be 20 to 30 feet high and seeding profusely and the small seedlings of the second generation from a few inches to a foot or more in height. The growth is exceedingly dense,

the Scots pine often forming impenetrable thickets of stuff 20 to 30 feet high, 6 inches in diameter at the butt.

These grassy plains, however, are considerably different in their characteristics than the grassy areas in this country. On Hanmer Plains there is an annual precipitation of 48 inches and an average of 132 rainy days per year, temperatures in the last 13 years have not exceeded 98 degrees nor have they fallen below 8 and in most years not below 20 degrees. It has been proposed by Mr. Morrison to plant trees of European and North American conifers in various spots on the Hanmer Plains without any particular preparation of the site or protection from grazing or other injury. In a comparatively short time these will seed up the areas far to the windward and will finally convert the whole plains region into a valuable timber region covered with trees growing at an exceedingly rapid rate. This system would be extremely useful on account of its economy. It probably could be duplicated in no part of the United States since our grass areas are very much more dry.

Morrison, W. G. *Some Proposals With Regard to Natural Afforestation in a New Zealand Mountain Area*. New Zealand Jour. of Science and Technology, Vol. 2, July, 1919; pp. 339-349.

In restoring the forests in the area devastated

Two Species by the war, species should be chosen which are
Not To Be of rapid growth and capable of furnishing usable
Forgotten products in a short period. On the other hand,
 in restoring portions of the forest in the midst
 of otherwise undamaged stands, the work should be conducted with a
 view to obtaining new stands as nearly as possible of the same type as
 those already existing. This means high forests of conifers in the
 Vosges mountains and coppice under standards in the greater part of
 the forests in the plains. In the Vosges, plantations of the "green"
 form of Douglas fir are indicated. In the plains, black locust and white
 alder (*Alnus incana*) should be given careful consideration because
 of their rapid growth, ability to reproduce by suckers, and immunity
 from insect damage. White alder, while less known than black locust
 and producing a less valuable wood, is more tolerant, thrives in dry,
 calcareous soils, and suckers very abundantly. These, however, are
 not the two species referred to in the title of the article. From an
 economic point of view, it is essential to replace as quickly as possible
 the high forest trees which have disappeared whether the coppice will
 recover naturally or must be replaced artificially. White (Weymouth)

pine (*Pinus strobus*) and white poplar (*Populus alba*) are the two species particularly recommended for this purpose. White pine has a great advantage in being intermediate both in tolerance and in density of crown. It will come in naturally in the midst of broadleaf stands, and will also permit the establishment under its shade of such hardwoods as hornbeam, maple, ash, and even the common oak. It is well acclimated to the French climate, and will thrive on many soils. It is particularly suited for the formation of a high forest of conifers over a coppice of hardwoods, which is the only form of stand in which its use is recommended. This is because the tree must be allowed to reach fairly large size in order to form any considerable portion of heartwood, the sapwood being regarded practically as waste, during which time a return is yielded by the hardwood coppice; and because the white pine is nearly everywhere attacked by a fungus with a subterranean mycelium, the spread of which is prevented when the trees are grown far enough apart so that their roots do not come into contact with each other. White poplar has been looked upon somewhat askance because the abundant suckers which it produces have sometimes proved a nuisance in adjacent agricultural lands. These suckers would do no harm in the forests where its use is recommended because of its rapid growth, coupled with the production of a merchantable wood which is among the best of the poplars. It is especially suited for use in naturally deep, fertile soils such as those formerly used for agriculture, but which have been so cut up by trenches and by shell holes as to be useless for cultivation for many years. The Japanese larch (*Larix leptolepis*) might also prove a desirable species to use along with white pine and white poplar, but not sufficient is known regarding its behavior in France to warrant too hearty endorsement.

S. T. D.

Jolyet, A. *Deux essences qu'il ne faudra pas oublier*. Rev. Eaux et Forêts. 57: 93-99. 1919.

MENSURATION, FINANCE, AND MANAGEMENT

Forest
Organization
in
Lorraine

The first representative of the forest hierarchy in Lorraine was the *gruyer* (a lord having a right on the woods of his vassals), who is referred to in public documents as early as the first half of the 14th century. On April 20, 1464, the office of *Grand gruyer* of Lorraine was established under which were a number of individual *gruyers*. The latter assisted, by a *controleur*, acted both as a forest administrator and forest ac-

countant, designating the timber to be cut, receiving receipts, and collecting fines resulting from trespasses. Following the French occupation in 1681, Louis XIV abolished the *grueries* and the *Maîtrise royale* of Metz became the headquarters of forest administration in Lorraine, while in 1686 the Duchies of Lorraine and Bar were divided into thirteen individual *maîtrises*. The *controlcurs* of the former *grueries* were replaced by special *receveurs* charged exclusively with collecting the returns from the forest. With the end of the French occupation, this organization was in turn abolished by Duke Leopold who re-established the *grueries* while retaining the special *receveurs*. The former, relieved of their accounting duties by the *receveurs*, frequently added the duty of provost to their other duties. In 1701, the duchies were divided into five forest departments, each in charge of a *commissaire réformateur*, to which a sixth was added in 1720. These *commissaires réformateurs* constituted a special chamber in charge of all questions relating to the management of the forests, including cuttings, clearings, and the exercise of rights of user. In 1720, this chamber was joined with the Council of Finances to form the Council of Finances and of Waters and Forests. In 1727, the *commissaires réformateurs* were given the title of *Grands Gruyers*. From the coming of Stanislas in 1737, it was the Council of Finance and Commerce which exercised complete authority in all forest questions. In reality, however, the council was controlled in forest matters by Paul-Francois Gallois, who after some difficulty succeeded in substituting the French system of *maîtrises* for the former *grueries*. The reorganization was completed in 1747 when Lorraine and Barrois were divided into 15 *maîtrises*. Each of these was in charge of a *maître*, who was generally assisted by a lieutenant, an agent of the king (who was concerned particularly in controlling rights of user), a hammer keeper, a surveyor, a clerk, and from one to ten bailiffs. These offices were all purchasable and all hereditary. On the death of Stanislas in 1766, Lorraine was reunited to France, and became the 19th department of forests and waters, and in 1789, on the death of Claude-Nicolas Mathieu, who had been *Grand Maître* of Waters and Forests in the Duchies of Lorraine and Bar, that office was discontinued.

S. T. D.

Viardin, L. *L'organisation forestière, avant 1789, dans la Lorraine reconquise*. Rev. Eaux et Forêts. 57: 80-85. 1919.

UTILIZATION, MARKET, AND TECHNOLOGY

• *War and
Wood
Preservation*

Wood preservation practically ceased in Germany during the war on account of the difficulty of securing preservatives. Creosote and corrosive sublimate were both commandeered by the Army, the former for fuel and the latter for sanitary purposes. Fairly large quantities of zinc chloride might have been obtained, but "war profiteers according to custom made the price prohibitive." Copper sulphate could not be obtained, and sodium fluoride could not be made on account of the shortage of sulphuric acid. No other tried materials were available. Moll predicts that in the future most of the creosote will be used for fuel and its use as a wood preservative will be limited to marine work for which other preservatives are unsuitable. For ordinary purposes there will be an extraordinary increase in the use of water soluble salts, particularly sodium fluoride and corrosive sublimate. Due to the increased cost of wood, preservative treatment will have an important part in the economic program of the reconstruction period.

G. M. H.

Moll, F. *Influence of the War Upon the Preservative Treatment of Wood.* Zeitschrift für angewandte Chemie, Vol. 31, page 224 (Nov., 1918).

EDITORIAL COMMENT

From the "slap-dash" methods of determining tax assessments to which we have become accustomed, the pendulum has swung to the extremist other side in the Bureau of Internal Revenue in its questionnaire on the forest industries, worked out by the newly organized Timber Section (headed by a forester). The questionnaire contains not less than 289 questions, designed to enable the bureau to assess with absolute justice income and excess profit taxes in proper relation to the capital assets. How complicated this determination is for the so-called "wasting industries" like lumbering, appears not only from this array of questions but also from the efforts to make the questions intelligible. Not only does the bureau place regional valuers in their districts, who by various means are to elucidate the subjects to those concerned, but the National Lumber Manufacturers' Association has issued a 12-page type-written explanation of the questionnaire, prepared by E. T. Allen, Forester of the Association, and expects to follow it up with a full-sized primer.

Bewildering as the amount of information to be worked out by the individual concerns will be, what master mind will be able to compile and utilize the vast amount of information! We are afraid that after all a process of simplification will have to be invented in this matter. And might not this simplification eventually lie in the direction of giving up the taxation of industries, and taxing individuals alone?

We may add that there are no irrelevant questions asked, and that Mr. Allen's explanations are most lucid.

The American Paper and Pulp Association at a business conference on November 14 accepted a report of its committee on Forest Conservation with suggestions for a national forest policy. It takes the position that there is "no basis for any legal compulsion upon the private landowner to keep his land forested except in cases where after proper classification and indemnification it may be decided that the general welfare demands watershed protection," but it admits that the private owner "is under both moral and legal obligation to handle his property in such a way that it does not become a public menace and the State may require him to conduct his cutting operations in such

fashion as to lessen the fire danger." It declares that "the production of large-sized timber is too long an undertaking with too great hazards and too low a rate of return to attract private capital in adequate amount." It advocates a forest survey and land classification; public purchase of cut-over lands by National and State governments in co-operation, and also more vigorous extension of Federal co-operation with the States in fire prevention; fair forest taxation laws; a very large program of forest planting; nurseries and working plans and other means of aiding reforestation operations, especially for smaller land holders; and a definite policy in operating State-owned lands. It is also admitted that some paper and pulp concerns might practice forestry on their own lands.

With this attitude and program we can certainly not find any fault. It expresses all that we have contended for as practicable means for carrying out a national forest policy. What we need now are definitely drawn acts of legislation.

Some trouble of minor character seems to have arisen from the use of the term "woodlot" to designate the small parcel of land devoted to tree growth on a farm. At least the U. S. Forest Service lately sent out an inquiry asking for opinions as to what term to substitute, suggesting at the same time the terms "woodland" and "woods." Some sixteen foresters replied, and, without very cogent reasoning, seemed to come to a general agreement in favor of discarding "woodlot" and accepting the two terms suggested without distinction.

We cannot agree that the substitution is a happy one from a linguistic point of view. There are three ideas that are to be expressed in the term: wooden condition; small extent; attachment to a farm. "Farm woodlot" really expressed these ideas perfectly; "lot" denoting a parcel of land of limited area, as a city house lot. The only or main objection to the use of "woodlot" seems to be that, outside of New England, the word is not current. That, in our opinion, only enhances its quality as a term. To overcome personal objections, moreover, "lot" may be left out and "farmwoods" would still convey the three ideas. If the size of the lot is such as to warrant it, "farm forest" may be substituted. "Woodland" to us conveys the idea of large extent, and is of such generic character that it is hardly fitting to use it as a species name. In inventing terms we must never forget the object. In this case we want to express special economic as well as silvicultural conditions which attach to the small parcel as a species of woodland.

B. E. F.

The Lumber World Review has done and is doing a great service by opening its pages as a forum for discussion of the question of a permanent timberland policy. The fifth issue, containing such discussion, is before us, and brings, besides a clever, suggestive analysis of the origin of private property by the editor, two contributions by foresters who come to the agreement, implied rather than directly expressed, that not much may be expected from private timberland owners in the way of providing for the future. Professor Recknagel, to be sure, merely interprets the viewpoint of his employers, the Empire State Forests Products Association, based upon the resolutions printed elsewhere in this issue. He concludes that New York State is in a different position from other States in the Union and should be allowed very largely to "paddle its own canoe." "We already have all the restrictive legislation which is needed, and we are on the way in this State to remedy the defects in our system of conservation and to provide the amelioration essential to secure the practice of forestry throughout the State." This seems to us a rather optimistic attitude.

Professor Hosmer considers that, before a broader national policy can be developed, six things may precede, namely, better protection from fire; a comprehensive timber census; a program of forest land classification; promotive measures by the Federal Government, particularly for the benefit of small holdings like farm woodlands; juster methods of forest taxation; continued acquisition by the Federal and the State Governments of additional land for public-owned forests. The long-time element, however, and financial considerations lead him to the necessity of State forestry in the end.

B. E. F.

The University of Washington Forest Club Annual for 1919 contains the following sentence: "One of the greatest needs of the College of Forestry and Lumbering is a larger enrollment, and particularly larger graduating classes, so that the college can fill more of the calls for positions in forestry and lumbering." This is gratifying, and to the casual reader might appear to signify that forestry practice—constructive forestry—silviculture has at last arrived in the forest. We are afraid this conclusion is a mistaken one, and the call for positions has been and is for logging engineers to practice "destructive forestry." That this interest is prominent in the institution is apparent from the whole contents of the Annual, which contains mainly accounts of logging operations and cognate subjects. Silviculture, as far as we could find, is mentioned only once as practiced in Dalmatia!

B. E. F.

NOTES

NOTES FROM DEUTSCHE FORSTZEITUNG

The following notes abstracted from various numbers of the *Deutsche Forstzeitung* (February 9 to March 16, 1919) are of interest.

Prussian Forests and the Revolution.—The social upheaval in Germany following the cessation of hostilities affected even the forests. For instance, on January 11 a party of about 50 people, armed with axes and saws, invaded the state forest in the Hanau district, and began to fell trees indiscriminately right in front of the forester's house. When he protested they drove him off with axes. Soldiers stationed nearby sided with the trespassers. A few days later another party of 50 or 60 men committed similar depredations on another part of the same forest, informing the forest officer that they were authorized to do so by the official appointed by the Soldiers' and Workers' Council of Hanau.

The forests near Nuremberg suffered even worse. Hundreds of men, women, and children helped themselves to the timber, not only for their own use but to sell. Areas of 20 to 30 hectares were cut clean; even telephone and telegraph poles were cut and the wire carried away. From 60,000 to 70,000 marks' worth of wood was thus stolen from the Nuremberg crown forest each day.

Seeding in Furrows.—Hegemeister Streck asserts that regeneration of clear-cut areas can be done fully as successfully by seeding as by planting. He has used a system of strip seeding with excellent results both as to germination and as to survival through dry years such as 1911, 1915, 1917, and 1918. In 1911 and in 1918 the spring droughts were so severe as to kill even ten-year-old pines, while the one to four year old plants in the seeded strips nearly all survived. The 1918 seeding which covered 23 hectares was a complete success. He cleans off the raw humus from strips 50 cm. wide, spaced 1.5 meters apart, and in the middle of the strip makes a furrow 10 cm. wide and of the same depth. This is done in the fall, and early the next spring the seed is sowed in the furrows and covered. Emphasis is laid on the need for carefully removing all of the raw humus, and for sowing the seed early so as to take advantage of the winter moisture.

German Wood and Lumber Prices.—The German lumber market seems to have been somewhat demoralized early in 1919. It is reported

that while fuel wood, particularly beech, was high in price, beech and fir lumber was very little in demand, but pine lumber was rather high because needed for car building. Many beech logs cut during 1918 were still in the woods, because of lack of transportation facilities, while the factories had supplies on hand to last until the fall. Beech boards were worth from 33 to 50 marks per cubic meter; beech logs of 30 cm. diameter and upward, 25 marks per cubic meter where less easy to get out, and logs of 40 cm. and up, 46 marks in the more accessible situations.

In Hesse wood cutters received 7.5 marks per cubic meter for cutting fir stem wood, and 5 marks per cubic meter for firewood, and were asking for still higher wages.

Sales of oak in the Spessart recently brought record prices. One cubic meter of stem wood for furniture brought 3,600 marks, while the average price received for all stem wood (1,229 cubic meters sold) was 916.27 marks. Stacked wood averaged 54.39 marks per cubic meter. Beech also brought three times the pre-war prices.

Sea-Going Log Rafts.—The lack of shipping in 1918 led a Swedish company to undertake the rafting of logs from Haparanda to Copenhagen. The raft was 112 meters long, 16 meters broad, and 8 meters high, with a draught of 5 meters, and contained about 9,000 cubic meters of wood. It was propelled by two steam engines, and made an average speed of 1 kilometer per hour. The cost was about 100,000 kroner, as compared with 130,000 to 140,000 by ship at prevailing rates. The same company expected to ship about 40 more similar rafts.

FOREST FIRES IN MONTANA AND IDAHO

Following the disastrous fire season of 1919, District Forester R. H. Rutledge selected a board of nine men to review the record and ascertain, if possible, what could be done to remedy the situation. This board visited each Forest, by splitting up in three sub-boards of three men each, who went over the fire records with the supervisors and rangers. Following this two weeks were spent as a general review of the situation, after which a final report was prepared. The most important recommendations of the board follow:

1. A very aggressive campaign of fire prevention will be inaugurated. Man-caused fires have increased at an alarming rate. This is probably due to the greater use of the Forests, but the curve should be going down instead of up. Various methods of attack are proposed, such as building camp sites, where fires can be built with safety, and require-

ment of permits before any camping can be done in certain parts of the National Forests. The campaign of law enforcement, involving the education of forest officers in the rudiments of detective work, posting of signs and active newspaper campaign, also more severe railroad fire legislation, is proposed.

2. The board concluded that for inaccessible forest areas (those located 15 miles or more from an automobile road), the general labor market has proved inadequate to furnish fire fighters of the quality, or within the time limit necessary to control forest fires. For such areas it is proposed to take eighty per cent of the average fire fighting cost during the past five years and make this money available annually for the employment of crews of men to be used throughout the fire season within the inaccessible forests. These men will be used to build trails when not needed for fighting fire. It is tentatively proposed that no other expense will be incurred for fire fighting beyond what can be accomplished by this force, and it is confidently expected, and there is every reason to believe that the actual cost of fire protection will be greatly reduced; the protection will be more effective, and at the same time the forests will be more rapidly equipped with trails, roads, and telephone lines.

For accessible areas the board recommends the stationing of soldiers to take the place of the fire fighters obtained from the general labor market. Fire fighters hired at an hour basis have shown such gross inefficiency and lack of interest that the board concludes it is almost useless to spend the money necessary to get them from the various towns to the fires, and no other solution seems within reach except the use of soldiers.

J. F. PRESTON.

OFFICES OF MARYLAND STATE BOARD OF FORESTRY COMPLETELY DESTROYED BY FIRE

The offices of the Maryland State Board of Forestry in McCoy Hall, Johns Hopkins University, Baltimore, were destroyed by fire in the total destruction of the building on Thanksgiving night, November 27. With the exception of some publications and exhibit material which was kept in another building, everything was destroyed, including valuable records representing several years of field study and investigation, a report in manuscript form, 700 lantern slides, some 1,500 photographic negatives, about 3,000 photographs, a forest library of some 200 volumes, together with a nearly complete set of State publications on forestry, and publications of the Federal Forest Service. One

of the most serious losses was that of the files containing the mailing lists and official records, which cover a period of thirteen years of State forestry work. In some respects it is necessary to begin the work over again, although the published reports contain a record of fair accomplishment. Since the mailing list will have to be entirely remade, it is important that those who wish to secure future publications of the Maryland State Board of Forestry should make application to be entered on the new mailing list.

A bill was introduced in Congress in November, extending the operation of the Weeks law "for the protection of the watersheds of navigable streams and to appoint a commission for the acquisition of lands," etc., and making appropriations therefore at the rate of \$2,000,000 for five years, in all \$10,000,000.

From the report of the Forest Reservation Commission for 1918 (H. R. Doc. No. 1495, 65th Congress, 3d Session), we learn that out of 9,678,575 acres of surveyed watershed 1,651,790 acres have been approved for purchase, the price ranging from \$1.50 to \$15, and averaging \$5.25 per acre, the whole amount expended so far being \$8,675,842. Of this acreage about half is culled and cut over, one-eighth in young growth, nearly ten per cent are classed as burned, barren, or stocked with unmerchantable timber, and the balance abandoned farm land. The respective purchase acres have been aggregated into four National Forests, namely, the Alabama, the Natural Bridge, the Shenandoah, and the White Mountain.

The report refers with satisfaction to the fact that these forest lands, besides their influence on waterflow, have demonstrated their utility from the supply point of view during the war. They have furnished walnut timber for airplane stock, as well as spruce, chestnut wood, and chestnut oak bark for tanning purposes.

The College of Agriculture and Forestry, University of Nanking, China, makes it its business to collect tree seeds for sale, applying the profits to "the furthering of forestry in China." To facilitate trade in the United States, bills may be paid to a special treasurer of the University located in New York, Mr. Russell Carter, 156 Fifth Avenue. Some thirty species are offered, but most of them of only ornamental value to us so far.

At the conference arranged by the New York State Forestry Association at Syracuse on November 15, all points on which there was

not thorough agreement were eliminated from discussion. This led to the formulation of resolutions of a most general character regarding the need of a timber census, increased effort in fire protection, revised forest taxation, and State assistance in private forest planting.

Dr. Carl Hartley, pathologist in the office of Forest Pathology, Bureau of Plant Industry, has recently resigned to accept a position as pathologist with the Institut voor plantenziekten en Cultures, Buitenzorg, Java.

The research force of the Forest Service in the Northern District has been reinforced by the addition of Mr. W. C. Lowdermilk, who was transferred from Albuquerque. Mr. Lowdermilk has recently returned from France where he served with the 20th Engineers. His education in forestry was obtained in Europe. He has been named as the liaison officer to correlate and digest the intensive research being done with current silvicultural practice. He will also undertake some research work in connection with this particular responsibility.

The research force, in addition to Mr. Lowdermilk, consists of Mr. J. A. Larsen at the Priest River Experiment Station, and Mr. P. C. Kitchen at the Savenac Nursery. Mr. Kitchen is devoting all of his time to nursery and planting studies.

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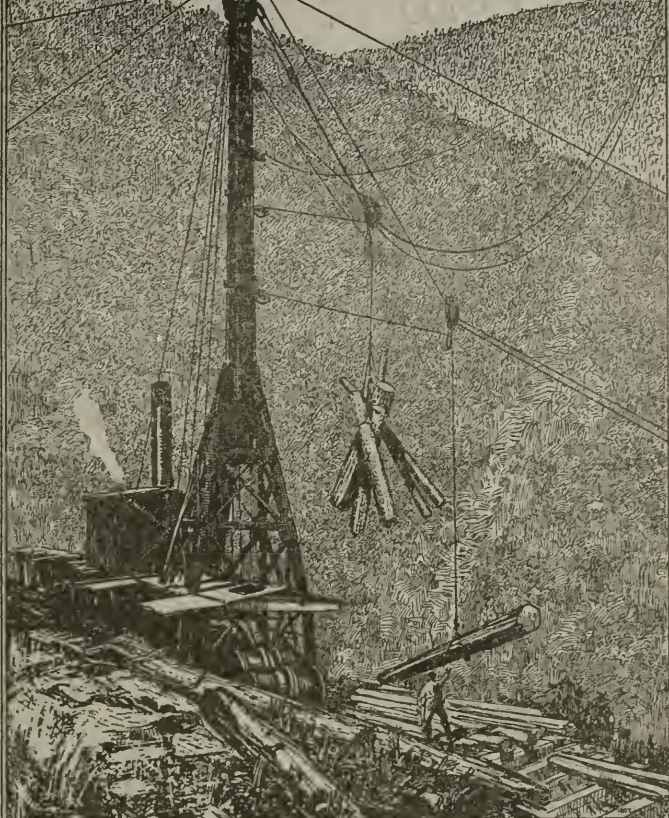
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THE YEAR'S ACCOMPLISHMENTS¹

By FREDERICK E. OLMSTED

Retiring President of the Society.

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Looking back on the accomplishments of the Society during the past year, I should say that we had begun to wake ourselves up. Our interest in forest issues of importance to the profession and to the country is alive. This is a healthy symptom, because heretofore we have been somewhat too much absorbed in our own internal affairs. Such a body of men should make itself of direct value to the nation in the discussion and solution of all those complex problems relating to the perpetuation and use of forest resources; and if foresters as a group can make their voices audible there are surely immense possibilities for influence.

Considering the broad training and experience and the many-sided work of the American forester there is ground to question whether he has made his influence count in the past as it should have counted for the advancement of his profession and the application of his knowledge. Individually, he has been felt; but considering the profession as a whole, foresters have lacked that vital influence for progress which comes from united effort, from the group spirit. The majority of foresters are in Government service and for this reason, perhaps, have been somewhat restricted in their vision of nation-wide problems outside of their own work and in the expression of their views. This is inevitable, for the demands of Federal and State forest service have been and still are predominant. Let me urge, nevertheless, that foresters in Government service endeavor to think and act on forest problems of the moment from viewpoints apart from their official surroundings; and that they express their views, so far as may be proper, as foresters

¹ Report made to the Society of American Foresters at its annual meeting in New York, N. Y., January 14, 1920.

rather than as Government officials. If they can do this, as I am sure they can, much will be gained for the profession.

The all-absorbing question which now confronts us is how to prevent the devastation of forest lands. It is a question, moreover, which has passed beyond the stage of discussion between the forester and the lumberman. It is now a question for adjustment between the public and the lumberman, and the forester's duty is to crystalize public opinion upon a sound program. In the end, what the public decides should be done, will be done. I, for one, believe firmly that foresters will unite upon a wise plan and that the public will approve and apply that plan without undue delay. I believe just as firmly that the application of that plan will place the lumber industry upon a basis of stability, prosperity, and public service hitherto unknown.

In order to focus attention upon some definite plan for stopping forest devastation, various committees were appointed with instructions to prepare recommendations for discussion and action by the Society. The Committee for the Application of Forestry considered the problem as a whole, and from a broad standpoint. Its findings have recently been announced and, I think, are worthy of careful consideration by every forester. Although not all of us shall agree with its recommendations let me suggest that the report be criticised in a constructive spirit, and that objections be supplemented by concrete alternatives. As the principles advanced by this committee are not such as may be approved or rejected off-hand, it might be well for the Society to act only after full and free discussion, considering at the same time the various other programs which have been or may be formulated. The pages of the JOURNAL OF FORESTRY will, I feel sure, be open to untrammelled discussion. I take this opportunity to thank its managing editor, Raphael Zon, for his valuable and pertinent suggestions to the committee, for his steadfast attitude of fairness, and for his thoroughgoing insistence upon his right to edit a free press. While Zon's professional work is as yet largely unappreciated he has quietly taken his place beside the few big foresters of this country.

Other committees from the Society, whose recommendations will soon be published, have considered the subjects of forest taxation, forest insurance, and forest loans, approaching these important problems from the somewhat new standpoint of the public's interest in the management of private timberlands. Committees are also engaged in outlining a scheme for the better business organization of the Society (including the management of the JOURNAL) and in preparing a plan

for forestry classification. The matter of a union for foresters is also receiving attention. Of decided importance to the profession is the work being done by representatives of the Society in co-operation with the National Research Council, and by the committee which is advising with the Joint Congressional Committee on the Reclassification of Government Employees.

Rather close association with the work of the Committee on Admissions leads me to believe that we are still splitting hairs on the subject of membership qualifications and that this is due, largely, to the complexity and vagueness of our new constitution. In my mind we should endeavor to unite the foresters of the country in a democratic band for the cultivation of professional pride, for the free interchange of ideas, and for the advancement of forest work. I am inclined to think that our constitution is a bit too rigid for a young Society and that a further revision aimed at the simplification of membership qualifications is much needed.

The organization of local Sections of the Society has been a great step forward. These local branches afford excellent opportunities for the growth of comradeship among foresters and for the discussion and solution of forest problems of peculiar importance to the various regions concerned. Many of the Sections have submitted their own plans for the prevention of forest devastation and in other ways have shown a lively interest in worth-while forest affairs. In many instances, moreover, the sectional organizations tend to inject a fresh point of view into the often restricted horizon of official routine. The further revelopment of Sections should be heartily encouraged.

Comment upon the continued improvement of the JOURNAL OF FORESTRY is superfluous, for its progress is evident to all of us. It has become an organ which both creates and reflects live issues of concern to the forester, while maintaining its high professional standards. The circulation of the JOURNAL should be and will be increased, and I look to see its influence for good greatly enhanced in the immediate future.

My duties as President of the Society have been thoroughly enjoyable. Opposition has developed from time to time, called forth in part by modes of expression. An attempt was made by a small group of foresters to suppress the report of the Pinchot Committee, an attempt to gag free speech which met with well deserved failure. All such opposition has helped immensely to compel attention and draw support for fair play.

Attempts have been made, of course, to cloud the issue before us. Lumbermen have argued that the private owner can not afford to plant young trees on his devastated lands. Nobody has suggested that he be compelled to plant. It is stated that the private owner can not afford to hold his cut-over lands from sixty to one hundred years for another crop of timber. Nobody has asked that he be forced to do so. It is mentioned that we have timber enough left on the Pacific Coast for some years to come. Nobody has denied it. It is claimed that better protection against fire is all that is needed to prevent forest devastation. This is misleading. Better protection against fire is, of course, essential; but in order to justify the expense of protecting cut-over lands, we must see that forests are harvested in such a way as to leave a young growth of trees which is worth protecting.

It has been advanced, in terms so equivocal as to make it necessary to translate them into straight-forward English before answering, that the growing of trees is not necessarily a wise policy under all possible circumstances. Nobody believes that it is. It has been asked what this embryo disturbance is about, and why it should be necessary to stir up a lively interest in forest affairs at the present time. The report of the Pinchot Committee and the campaign launched by Colonel Graves are direct answers to those queries. It has been suggested that foresters and lumbermen sit down together and adjust matters. The futility of such a course has been amply demonstrated for the past fifteen years, and has been clearly exemplified during the year just passed. The lumber industry as a whole has been and still is tremendously inert and permeated with a spirit of indifference toward changes in its methods necessary for the safeguarding of public interests. As in all other great movements for industrial, economic or social progress, this inertia and indifference may be overcome only by means of pressure from without. Once more, the adjustment necessary is one between the public and the lumberman; an adjustment in which the lumberman will be brought to recognize that the public has a direct interest in the way in which he treats his forest lands, and in which the public will be forced to recognize that the continuous and prosperous operation of the lumber industry is of vital importance to the general welfare.

We have been referred to as theorists, and radicals, and general disturbers of the sylvan peace. As for theory, it strikes me that both lumbermen and foresters need much more of it. The implication that we are suggesting action of a radical nature is ingenious. When

the immense world changes now taking place in the structure of industry are considered, it takes a vivid imagination to discover radicalism in plans for an exceedingly mild public control of an industry which is badly in need of such control for its own good. At times I am inclined to believe that the measures suggested are so conservative as to be of doubtful efficacy. One thing, however, is sure: if the operations of the lumber industry are not soon brought into accord with the public welfare through reasonable, nation-wide changes, let that industry beware of public pressure later on which will be of a genuinely radical character. It is to avoid the many disturbances of a radical change that foresters are now endeavoring to agree upon a sound and liberal plan for control, to lead the public to adopt that plan, and to bring about its adoption without disruption.

We are proposing to stop forest devastation by means of appropriate legislation, precisely as other injuries to the public welfare are stopped. Only through legislation may effective, uniform, and fair measures be applied. In proposing such legislation we intend to see that the lumber interests are equitably dealt with, just as we propose to see that the public interests are thoroughly safeguarded. The belief, still persistent in some quarters, that the lumberman should adopt only such measures as will bring him greater immediate profit, methods only of a so-called "business" character, fails to take into consideration the fact that the question of forest devastation is of national public concern, that it has passed far beyond the field of the individual timber holding. The only question of a business nature to be answered is "Will it pay the nation to stop forest devastation?" There is but one answer to that. Will the lumberman lose? How can he lose when his own permanent prosperity hangs upon the perpetuation of his raw material and a generous use of that material by the public? The continued prosperity of the lumber industry under methods which devastate is inconceivable.

That the Society of American Foresters will play an important part in the struggle to come is my earnest wish. That its influence in molding public opinion will be vigorous and sound I have no doubt. I retire from office with a sincere appreciation of the opportunity granted me by the Society for taking a part in the fight for the advancement of forestry in one of its vital stages.

THE REAL ISSUE

BY HENRY S. GRAVES

Forester, U. S. Forest Service

About a year ago we began serious discussion of a national policy of forestry. Very divergent views have been expressed about the economic situation of our forests and wood-consuming industries, and about what remedial measures are necessary. It is significant that the more the situation has been discussed and diverse views expressed, the more a few fundamental principles of importance have become emphasized, and the matters of less importance have retreated into the background. Mr. Pinchot and his committee worked out their policy quite independently of the group in the Forest Service. Yet we find the committee making as their great objective the stopping of the destructive processes that are turning forests into real wastes. We find emphasis being placed upon the responsibility of timberland owners to handle their lands in a way not to injure the public, emphasis upon the responsibility of the public, not only to own and rightly handle extensive public forests, but to cooperate with and aid private owners, and emphasis also on the imperative need that the public, through legislative and executive action, require owners to redeem their responsibilities in the prevention of forest devastation.

These are principles that I myself also have been advocating for a year, and they constitute the real issues that have got to be settled before we can go very far in the establishment of a national policy of forestry.

The committee is unanimous in the matter of the objectives and more important principles of a policy. A dissenting voice is raised by Professor Toumey in regard to the inclusion in the statement of policy of such matters as labor relationships, control of production, and other purely industrial questions. He also disapproves the principle that the Federal Government should exercise control over the handling of private forests, but asserts that such requirements as may be imposed on owners in forest protection and forest renewal should be through the agency of the States. The committee appears to reflect the differences of opinion that exist in the profession at large. Broadly speak-

ing, these represent also the differences between the committee policy and that which I have been advocating. These differences are very natural and certainly are not such as need cause any fear of a ruction among foresters.

The committee report suggests certain measures of industrial control and labor relationships. These suggestions are not explicit enough to make clear how far in this direction the committee would go. My inclination would be to handle purely industrial questions as a part of a public policy relating to other industries as well as the lumber industry. I would dislike to see the basic issues of a forest policy clouded by questions that, even though related to forestry, may be as well or better considered separately. This discussion should, I believe, be centered on the questions of land utilization and forestry.

I predict that after there has been some vigorous discussion of what should be included in a policy, whether the States or the Federal Government should exercise control over certain matters in private forestry, questions of taxation, insurance, forest loans, and so on, the foresters will find the issues that really matter concern the large basic questions such as that of individual responsibility and the character of requirements that may be imposed by the public on private owners. Men who agree on these basic principles can well afford to have a friendly controversy over ways and means and legislative programs, for even if we bump each other occasionally we are traveling essentially the same road.

Far different is the division between those on the one side who would impose real requirements upon owners to prevent devastation, and those on the other side who would simply continue about as heretofore their efforts to get results solely by education, demonstration, and subsidy. There is where the real issue lies, not whether public action should be exercised by the Federal or the State Government, or just how far the public should go in the direction of control of industries.

CONSTITUTIONALITY OF NATIONAL LAWS TO RESTRICT FOREST DEVASTATION

BY GEORGE W. WOODRUFF

The opinion of even our best lawyers on questions of constitutionality are of little importance until a decision of the Supreme Court is obtained, and that is impossible except after the enactment of the disputed law. Therefore we should not be frightened out of striving for good legislation by an outcry concerning its possible unconstitutionality. Hardly any of the progress in conservation would have been possible if the views of our most noted lawyers had been heeded. The Supreme Court ruled contrary to their clamorous advice in the following instances, all monuments of the progress of conservation, and more important than their mere recital would indicate to the uninitiated:

1. In *Light vs. the United States*, the Supreme Court held it constitutional for the United States to enforce laws and regulations concerning the National Forests, including charges for special uses such as grazing.

2. In *United States vs. Grimand*, the Supreme Court held that trespass on National Forests contrary to the regulations of the Forest Service could be punished as a criminal act.

3. In *United States vs. Mid-West Oil Company*, the Supreme Court upheld the humble and much-condemned opinion of a small number of Government law officers by declaring it constitutional for the Executive to withdraw public lands from disposal.

4. In *Utah Light and Power Company vs. United States*, the Supreme Court held the water power regulations of the Forest Service valid, including the right to exact a charge and fix a limit to the life of the permit.

5. After President Roosevelt vetoed the James River and Rainy River water power bills and President Taft vetoed the Coosa River bill, the Supreme Court, contrary to the expressed views of Senator Knox and other great lawyers, held in *United States vs. Chandler-Dunbar Company* that Congress had power to provide for taking, developing, and selling or leasing the water power of a stream.

6. In *Baker vs. Swigart*, the Supreme Court upheld the constitutionality of the Reclamation Act, and the right to collect, from users of

water, the operation and maintenance charges fixed by the Secretary of the Interior.

I cannot draw your attention too strongly to the fact that in the one decade just passed the Supreme Court proved in the above six important instances that attorneys of greatest repute were wrong in their claims concerning the constitutionality of laws or Executive actions. If the proposition of your committee is not workable along constitutional lines, we will perhaps be obliged ultimately to try for a constitutional amendment as has been done in the case of the income tax, suffrage, and prohibition, and may be necessary to prevent child-life devastation. One reason why the ridiculed intelligence of our conservation law clerks during the years 1905 to 1910 hit the right answer when noted legal minds were guessing wrong was due to the principle which we then evolved for approaching these questions; namely, that we should expect to find constitutional provisions on which to hang valuable legislation, because the framers of the constitution declared that one of the prime objects they were trying to attain in conceding power under the constitution to the three branches of the Government, was "to promote the general welfare and secure the blessings of liberty to ourselves and our posterity." The conservationists discerned the "general welfare" in the natural resources, and were confident that one great element of "liberty to ourselves and our posterity" depends on preventing the perpetual acquisition or the permanent destruction of natural resources by monopolistic private interests.

Your Committee on Forest Devastation, consciously or unconsciously, followed the above plan and determined that the "general welfare" and the "liberty of our posterity," if not of ourselves, is acutely endangered. I think no member of the Society doubts the public need for legislation drastic enough to stop the forest devastation. Then approaching the constitution with our eyes prepared and expecting to find the constitutional permission for such a law, I am confident that the Supreme Court would uphold the proposed National legislation on some of the following grounds:

1. The protection of our navigable streams from flood, drought, and erosion by the prevention of harmful and ruinous lumbering along the banks and upon the water shed of such streams. If not, I believe our Appalachian National Forest legislation is unconstitutional, which I certainly do not want to consider.

2. I know that the Supreme Court held that the Child Labor Law was unconstitutional. However, I believe there is a hundredfold

stronger argument, based on the Interstate Commerce provision of the constitution, for a law to prevent forest devastation than there was in the case of the Child Labor Law; not because I apprehend that the devastation of child vitality is not more against the general welfare than the devastation of forests, but because, as far as forest products are concerned, it is well known that soon the majority of all our larger and better forest products must come to the East from a distance of approximately 3,000 miles, which means the extra use of thousands of locomotives, scores of thousands of freight cars, and tens of thousands of railroad employees, which together with the occupation and wear and tear of our railroad tracks and general equipment, undoubtedly affects interstate commerce to a very highly material degree. I cannot but feel that the Supreme Court would be inclined to say that legislation to stop further forest devastation and to help in reforesting devastated areas would tend to hold, restore, and maintain the equilibrium of Interstate Commerce in forest products, and would be constitutional under the power of Congress "to regulate commerce among the several States."

3. Even if the Interstate Commerce clause should be thrown to one side by the Supreme Court, it would be possible for Congress to tax such forest products as enter into interstate commerce and have not been produced in compliance with regulations promulgated under the National law. This is the plan now being tried by Congress to prevent the devastation of child-life.

In conclusion I would say that for us to start an argument pro and con the constitutionality of a National law to prevent further forest devastation would be futile. With no authorized umpire, the crack of doom would find the debate raging still, but no forests left. Instead of turning tail and running before the wind-inflated and demon-distorted bug-a-boo of unconstitutionality, we should follow the highly successful course of the conservationists, backed by the fine courage of Theodore Roosevelt, and described in the six cases set forth above; namely, take it for granted that what is for the general welfare and for the good of posterity can, as the framers of the constitution seem to intend, be sustained.

SELF-GOVERNMENT IN FORESTRY

BY W. B. GREELEY

Notwithstanding its many admirable features, the program recommended by the Committee for the Application of Forestry is not sound, in my judgment, in the following respects:

The grave doubt as to its constitutionality. Many lawyers call the proposal unconstitutional. Most of the others say in substance that only the Supreme Court can decide. It does not seem to me wise for the Society of American Foresters to commit itself to a program which in every stage of advocacy, of adoption, and of subsequent application must overcome this objection; and which stands a large chance of being thrown out by the courts after many years of effort have been expended.

Conflicting jurisdiction. Whether Federal legislation of the kind proposed is constitutional or not, there is no question as to the authority of the States to enact laws and create administrative agencies covering the same field. Many of the States undoubtedly will extend their existing forestry laws along certain of these lines. Conflicts in legislative and administrative requirements would be inevitable. Opportunity would be afforded for almost endless litigation, controversies between State and Federal authorities, and difficulties in administrative practice. The issue of an infringement of State jurisdiction would be raised and would add to the opposition to the proposal on its own merits, further opposition based upon the Federal assumption of State functions.

The situation thus created would, in my judgment, seriously confuse and hamper our national development in forestry. Because of the doubt as to its constitutionality and the unquestioned conflicts in jurisdiction which would arise, I regard the program as unworkable. I fear that it would fail to get results. It seems to me preferable to avoid these difficulties and obstacles by recognizing the field as one for State action and by bending our efforts toward getting effective State action backed by a large measure of Federal cooperation.

Its violation of the American conception of local self-government. The question of administrative means goes much deeper than technical interpretations of the constitution. To put a stop to forest devastation, the committee proposes an important extension of the prevailing American conception of the police functions of Government in relation

to property rights, that is, the responsibility of the private land owner to use his property so as to prevent a general economic injury. I believe that this principle is sound and that it must be recognized in any effective forestry program. But it is a departure from our past conceptions of individual rights in relation to public interests, and a departure which affects directly the existing and long-standing interests of hundreds of thousands of our citizens. Recognizing this fact, I believe that we should democratize the application of the principle and the ways and means of enforcing it as far as possible. We will get farther in the long run if we work for the adoption of this principle by and under the authority of our local forms of government and for its application through local administrative means, in which the people who are affected can be duly represented and whose policies they can influence as voters in their own State or community. In my judgment, this is the effective answer to the assertion that the proposal might become an arbitrary and confiscatory invasion of property rights.

It can be said, on the other side, that Federal machinery will afford the most uniform and effective enforcement of legislation of this character. Against that I, for one, would bank on the value of a real democratization of the idea, of the greater gain in the long run of developing local support for it, of making its application representative of local public sentiment and of the local interests which are affected. This is the American way of working such things out; and particularly in promoting a change in our national conceptions of individual responsibility of this character, I feel that we will get farther by beginning at the bottom instead of at the top. Instead of attempting to force this principle on the forest owners of the United States by Federal law and Federal machinery, will we not actually get more tangible results, more forest growth, by working it out State by State or section by section through their local agencies?

To recognize the States as the proper agency to deal with private lands within their borders in no way implies that the Federal Government should surrender its own proper and necessary functions in conserving our national resources. The continued Federal administration of public lands and the extension of National Forests are not involved in a program which seeks to arrest the devastation of private holdings through an extension of the police functions already exercised by the States over them.

The elimination of farm woodlots. I can see no justification for eliminating farm woodlots from the application of any forestry program. Unimproved farm lands, reported as aggregating 190,000,000 acres in the census of 1910, constitute a very important part of our

forest resources and represent the class of owners which, by and large, can best afford to keep their forest land productive. As far as probable agricultural use is involved, unimproved farm land should be on exactly the same footing as cutover timberland—both should be kept at work growing timber until they are actually utilized for some other purpose. To eliminate the large part of our forest land now embraced in farm ownership would not only reduce the effectiveness of the program but also gives it an aspect of discrimination which by all means should be avoided.

The inclusion of proposals dealing with purely industrial conditions. It does not seem to me desirable to inject into a forestry program, whose fundamental purpose is to stop the devastation of land, provisions dealing with relations between employers and employees in forest industries. This is an enormous subject in itself, which is simply part of probably the largest economic problem now before the United States. By including such planks in a forestry program, we tend to merge the forestry issue into this great economic discussion, where it would lose its distinctiveness and become the tail of the dog. Forestry deals with land; and whatever the views of the members of the Society as to a proper adjustment of the relations between labor and employers, we would do well to confine our efforts as foresters strictly to the problem involved in the use of land.

The program also suggests control of production under certain conditions. It does not provide for any complete or adequate plan of Government control of forest-using industries which would have to include not only production but also control of prices, capitalization, new developments, and many other features. In my judgment, we should eliminate this subject altogether. It leads us into another tremendous economic problem and field of controversy, in which our specific point of attack, the devastation of land, would again be apt to become submerged. Let us stick to the subjects in which, as foresters, we can claim some degree of expert knowledge and concentrate our drive upon the definite point of handling forest land, without involving other tremendous issues. In principle, I am opposed to public control of forest industries beyond the minimum requirements essential to stop devastation; but aside from the principle, I feel that it would be a mistake for the Society to confuse the specific thing which we are trying to accomplish and to create unnecessary opposition by injecting other questions which, while related, are not necessarily involved in practicable remedies.

In the final result, public interests must prevail over private interests to the extent that they conflict. Devastation must be stopped. This is not to say, however, that the forestry campaign must necessarily become a "fight" between the public and the timber owners. Let us first exhaust every opportunity for education, for showing forest owners that the arrest of denudation is to their own benefit, for obtaining their practical suggestions and active support in working out ways and means adapted to each region.

NATIONAL OR STATE CONTROL OF FOREST DEVASTATION

By GIFFORD PINCHOT.

The plan suggested by the advocates of State control and that of the Committee for the Application of Forestry both hold that the owners of commercial forest lands should be required by law to prevent the devastation of their properties. The spirit and purpose of both are the same. Both agree as to the facts, the fundamental principles, and the remedies. Each provides for both State and National action. The plans differ only in this—that the one looks to the separate States for the chief executive control, and the other to the Nation.

This is a difference in method only. If I believed that forest devastation could be promptly, permanently, uniformly, and efficiently prevented through State control, I should be perfectly willing to accept it. The means are unimportant. The result is everything.

CONFLICTS IN JURISDICTION.

Objection is made that National control involves a division of authority leading to conflicts of jurisdiction. I have observed that such anticipated conflicts seldom materialize. Under the smoothly working Reclamation Act, for example, the Nation builds works for the distribution of water controlled or owned by the State (a vastly more complicated problem), and both the States and Nation are actively concerned with regulated grazing. But if the avoidance of chances of conflict is so important, let us remember that the plan for State control, with standardization, supervision, and inspection by the National Government, is far more likely to breed friction than the simple and workable division between silviculture and slash disposal on one side, and fire patrol and fire-fighting on the other.

AMERICAN AND SAFE.

It is suggested that National control of this National question is un-American. The same objection was made against National control of transportation, corporations, irrigation, migratory bird life, and many other matters now seen to be rightly assigned to the National Govern-

ment. I cannot recall a case in which any matter so assigned has been sent back to the separate States, while it is easy to name many cases in which affairs once in State control have been transferred to the Federal Government, from which no one now suggests they should be removed.

If it be urged that the defeat of a single Federal appropriation might endanger the whole plan, I reply that the danger and the argument apply equally to the National Forests. Said Pudd'nhead Wilson, "Put all your eggs in one basket and watch that basket". By that method the National Forests have been preserved hitherto and today are safer than ever.

PARTICIPATION BY THE STATES.

The Committee's plan does not exclude the States, but proposes that they shall share with the National Government in preventing forest devastation. No plan could succeed which overlooked the vital necessity of creating and maintaining genuine local interest in the care of local forests. The States, and later on municipalities also, must of necessity have an important share in preventing forest devastation, and State forest forces must necessarily form essential parts of the nationwide organization.

SUBSIDIES INEFFECTUAL.

Under the State control plan each State must enact and maintain certain standards of law and administration in order to receive financial assistance from the National Government. Is it likely that the great lumber States would do so? It has been my experience that a Legislature can seldom be induced by considerations from outside to take action against the opposition of interests dominant in the State. The States where the lumbermen are strongest are, moreover, just those where forest devastation must be stopped. It would only be necessary for the lumber interests, when the time was ripe, to prevent the passage of bills in the three or four great lumber States in order effectually to cripple the whole plan of State control.

Theoretically, if the National Government were contributing to a State, and should discover that the conditions were being broken, it could withdraw its aid. Practically, if the attempt were carried beyond a mere threat, it would throw the whole question into politics, and would succeed, if at all, only against all the political pressure the State could apply. If it failed, the State's control would probably collapse, with the net result of time and money thrown away.

PRESSURE ON THE STATES.

Just as the waterpower monopolists and grazing interests formerly clamored for State control, well knowing they could themselves control the States, so now the lumbermen will be found almost without exception against Federal and for State control, and for the same reason.

In their fight to ward off governmental control the lumber interests will be joined by other interests engaged in exploiting the country's natural resources whose influence is nation-wide. States are seldom able to resist such pressure. *Under the plan for State control the public must attack the lumber interests in the lumbering States, where they are strongest; and without help from the deforested and treeless States, where the sentiment for conservation is most alive. The lumber interests would be fighting in their strongest trenches, the public from its weakest ground.*

It is obviously improbable that the several States will enact simultaneous and parallel legislation in the face of the fact that the lumbermen of any State that refuses to pass such legislation will have a material advantage in competition against lumbermen in the States that do.

NATIONAL CONTROL SAVED THE NATIONAL FORESTS.

During the years when the National Forests were being created and the Forest Service established, what saved them both was that both were free from State control. The opposition controlled practically all of the legislatures of the Western States, so that they passed resolution after resolution denouncing the Forests and the Service. Time and again the Forests and the Service were saved in Congress by the support of the Central and Eastern States. We have National Forests and the Forest Service today only because they were supported by forces which the State control plan now proposes to eliminate from the critical points in the fight.

WEAKNESS OF STATE CONTROL.

Many of our State forest departments and commissions have done good work. A few States have excellent forest laws, but in how many are the laws efficiently applied? How many States have started out with a definite forest policy and held to it? In how many has the forest work escaped serious injury from changes in policies and admin-

istration? In more than one State the forest departments are sterilized; in some, to my personal knowledge, positively bad.

Success in keeping forest lands productive calls for unity and stability in policy and management. To scatter the control among the States would be to subdivide and distribute it among numerous comparatively weak and frequently changing hands. A variety of State jurisdictions over what is distinctly one problem, nation-wide in scope and in effect, in my judgment cannot but fail. Moreover, there is no argument for State control which does not advocate with equal force the transfer of the National Forests to the States, with similar standards, supervision, and inspection by the Nation.

THE NATION ONLY CAN SUCCEED.

Once more, the kind of executive machinery we use to keep trees growing on forest lands is simply a question of how best to get the desired results. I am clear that only the National Government can do what the situation demands. To try State control first would, I think, be merely to lose time. The problem is National, and the Nation alone is strong and steady enough to handle it.¹

¹Articles will follow on the industrial and other phases of the Committee's Report.

SOME COMMENTS ON THE REPORT OF THE COMMITTEE OF THE SOCIETY

BY J. S. WHIPPLE

The following is my estimate of the report submitted by Mr. Pinchot and his committee under date of November 1, 1919:

There can be no difference of opinion about the facts set forth in the first section headed "The Facts, Summary," except that many believe (and I am one of them) that the consumption by all means of destruction which includes fire is more than three times as much as the annual reproduction.

All will agree with the second section of the report, "The Forest Situation."

The statements in the third section, "A Timber Shortage," are equally true.

Section 4, "Timber supplies are decreasing," etc., is all well stated and will be approved of by nearly everyone as stating the facts, except as to the last paragraph. It is true, "efforts might be made to bridge the gap in three ways," as suggested, but only the last mentioned way will be efficient. The consumption will not be reduced and we cannot import more than we are now receiving; therefore, growing new forests is the only way. Every effort possible should be put forth to show the necessity of planting forests, and States and the National Government should assist in making it possible to plant on a sufficiently large scale to make the future in respect to an ample timber supply safe, by doing at least three things: (A) relief from taxation; (B) furnishing seedling trees to those who will plant, free of cost; (C) each State and the National Government leading and showing the way by immediately planting up their own waste land. Those States that own none of such lands should acquire a large amount and plant trees upon it.

To illustrate, the State of New York has expended a hundred and twenty-five million dollars on an enlarged canal, from which there will probably never be any considerable benefit and no return for the money expended. Had the State used that vast sum of money in planting the six million barren acres in the State with commercial

trees, the future timber supply for this State would have been cared for and a fine profit realized.

It is plain that growing new forests at home is the remedy.

The facts set forth in the fifth section of the report are true and well stated. "No practical decrease in wood consumption can prevent a timber shortage." Therefore, we must grow more timber.

Section 6, "Dependence on imported timber supply is fatal." That is true.

Section 7, "Our stock of growing timber," etc., is truly stated.

Section 8, "Our present forest cannot make good the deficit," is true.

Section 9, "Shortage due to devastation," is historically true. Had lumbering always been conducted on reasonable, conservative principles, much would have been saved.

Section 10, "Adequate evidence is now available." This section well enumerates the historical facts.

Section 11, "Forests in continuous production are practical." Other nations of people have proved it. We ought to know enough to do as well as they.

Section 12, "Location and condition of forest areas," states the facts, and about them there will be no controversy.

Section 13, "Policy of private holders." The committee undoubtedly states the truth.

Section 14, "Annual consumption." Here for the first time the true amount of wood used has been stated. The statistics have never shown more than half of the consumption.

Section 15, "Present annual growth." I doubt if the annual growth is 35 billion feet. My observation leads to the belief that the take off by all cutting and loss by fire and other causes is six times the growth, and much of the new growth is not of the best and the new growth by self seeding of cone-bearing trees is very small; otherwise of hard woods.

Section 16, "Maximum growth." The subject matter in this section will be accepted as substantially correct.

Section 17, "Action required." This is an important section, and under it may arise the question as to the power of the National Government and of States to regulate and to some extent control the use of private property for the public good. For one, I have no doubt but that power exists in both State and nation.

Section 18, "Forest devastation." The war made the truth set forth in this section understood.

Section 19, "Devastation and consumer." The facts herein set out are true.

Section 20, "Devastation and the forest community." Facts correctly stated and the opposite situation is to be found in Germany.

Section 21, "Effect of forest devastation." True statement of facts.

Section 22, "Devastation and labor." History.

Section 23, "Devastation and farmer." The committee might well have gone farther and asserted that the farmer is more greatly interested than any other person, because in all the valley lands farms may be actually destroyed by complete deforestation.

Section 24, "The forests of the future." The committee here could well have gone much farther and asserted that the forests of the future would produce 80,000 board feet to the acre, instead of 10,000 board feet. "We want planted forests," should be the constant demand of all.

Section 25, "The proposed plan." I approve of this plan. I wish the committee had cited the four pointed judicial authorities for State and National control of privately owned timber lands.

Section 26, "Poorer lands to be used for forest crops." Plan is well stated and is feasible.

Section 27, "Obligation not to injure the public." Undoubtedly that obligation exists as established by many decisions.

Section 28, "Steady operation vitally important." A true statement.

Section 29, "Control must be national." I disagree partially. It must be by State and Nation.

Section 30, "National legislation should have three objects." All right except same applies to a State within its borders.

Section 31, "Should be maintained and increased." All right.

Section 32, "Suggested legislation." Plan is good as to National Government and as well applies to a State. The authority of a State should not and cannot be submerged by the Nation.

Section 33, I agree substantially with the suggestions of Mr. Touniey, as to rights and importance of States cooperating. It should be concurrent action in all respects.

Admitting all the facts set forth, the outstanding necessities are to plant forests quickly on a very large scale, on poor lands; such State and National control as will produce this result and protect the general public as against improper cutting of privately owned forests.

COMMENT ON THE REPORT OF THE COMMITTEE FOR THE APPLICATION OF FORESTRY

BY R. S. KELLOGG

The majority report of the Committee for the Application of Forestry in its suggested legislation suffers from the same illusion that has characterized many other well-intended undertakings, namely, that the panacea for economic and social ills is the creation of a vast National organization with power that may be applied at its own sweet will in detail throughout the length and breadth of the land. The regional administrative organizations proposed with executives and inspectors "to fix standards and promulgate rules to prevent devastation and provide for the perpetuation of forest growth and the production of forest crops on privately owned timberlands operated for commercial purposes" are types of bureaucracy that the American people do not want and are not likely to create.

More than once have we seen lamentable failures of foresters to secure the adoption of their policies because they have persisted in following purely theoretical courses without consideration of practical conditions. I do not mean to imply for a second that in order to succeed a forester must sacrifice his principles to expediency but I do maintain that no forest policy will succeed which basically antagonizes the owners of the land on which it is hoped to have forestry practiced.

A program of mandatory silviculture prescribed and enforced by the National Government in the manner proposed will antagonize not only the timberland owners but also the State authorities, many of whom are already making commendable progress in the solution of the problems under their jurisdiction. Both Bruce and Toumey share this viewpoint, and to my mind Toumey's reservations set up a program that is far more practical and feasible than that proposed in the majority report.

Toumey clearly recognizes that cooperation is preferable to compulsion in dealing with the private landowner, and also believes that assistance from the National Government in the working out of the forest program should be through State agencies. It would be most unfortunate were any attempt made to supplant the State organizations by

National control. Moreover, State legislation can unquestionably be made to apply to problems connected with the ownership and use of land when the same form of control by a National agency is of very doubtful legality.

It is, to say the least, regrettable that a report which purports to offer an adequate solution for a great problem should place its greatest emphasis upon measures whose value is highly debatable. Leaving entirely aside the many controversial questions that are immediately aroused through proposals to compel the private owner to practice forestry whether or no, there are numerous important steps of immediate practicability that can be undertaken with the unanimous approval of foresters, timberland owners, and the public.

First, and foremost, is fire prevention on a much larger scale than has yet been attempted? This is a problem both National and State, and unless fires are better controlled than they have been there is little use in talking about silviculture operations of any character.

Second, there should be set up on the part of both the National and State Governments a permanent policy of purchasing cutover lands of the right character and suitably located for additions to, or creation of, public forests.

Third, no forest planting program yet under way will within a hundred years be sufficient for the restocking of the barren land which is fit only for timber growing. Why not increase this program?

Fourth, no plan for permanent forest supply can be either adequate or properly executed in the absence of a general timber survey and land classification.

Finally, there are many private owners who are willing to help maintain the timber supply if they are given fair taxation and assistance in fire prevention and forest management. Why not help them? No fair-minded man can object to making certain definite requirements of every forest owner in case he is to receive benefits from the public, but it is neither fair nor just to single the forest owner out for compulsion as to how he shall handle his land when the owner of every other kind of land is permitted to use it or abuse it as he sees fit.

My own belief—many times stated before—is that to grow the bulk of the older and larger-sized timber, public ownership of the land—National or State—with private cutting under proper silvicultural regulations is the most feasible solution of the problem. I do not overlook the fact that for certain species and sizes of timber used for particular purposes, forestry is now possible for the private owner and

should be increasingly so in the future, but the production of large-sized timber is too long an undertaking with too great hazards and too low a rate of return to attract private capital in adequate amount. State and National Governments, whose primary concern is the welfare of all citizens and industries, can best afford to engage in such undertakings. On the other hand, the public will get better and cheaper service if the operations of transforming stumpage into merchantable commodities and their distribution are left to the energy, initiative, and ingenuity of private capital.

It is greatly to be hoped that definite measures looking toward an increase and perpetuation of the timber supply will result from the present varied and sometimes heated discussions, but it is also as greatly to be hoped that instead of attempting to secure legislation now which, if ever appropriate, will not at least be so in the present generation, the foresters of the country will unite upon an immediate program, the soundness of which will be conceded by all interests.

It is entirely possible to work out a program of this sort in which no forester need sacrifice the principles of his profession and yet in which he can join hands with the lumberman and the timberland owner and secure that necessary public sentiment without which any plan is doomed to failure.

THE FOUR AND THE FOUR THOUSAND

BY BRISTOW ADAMS

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At the annual meeting of the Society of American Foresters, held in New York, January 14, 1920, much was said about the "recalcitrant four." They had taken exception to a widespread newspaper distribution of a committee report before the Society had a chance to see it, and had the courage to stand on their action, which was unanimously supported by the New York Section.

Because of the need of closing the New York meeting before discussion was had on the report, and because "the Four" did not have time to bring out fully the motives of their action, this paper is offered. Not that the Four were unable or unwilling to state their own case or to stand upon it as stated! Yet one basic fact was not brought out: They wished to strengthen the report. In connection with their wish, this paper seeks to answer a query made at the meeting—"whether the Society wishes to take any action that will guide its officers and committees in a similar situation in the future, should it arise?"

The report of the Committee for the Application of Forestry should have been submitted to a referendum in the first place, to gain a strong consensus of opinion concerning it. Then that opinion would have formed the program of the Society, with the Society's backing, instead of appearing as committee report, with variations or reservations among the committee.

Instead of that, what was done? The committee, before the Society had a chance to see the report, put the matter to a trial by newspaper, instead of to a judgment of foresters. On Mr. Pinchot's statement, the published report went to about four thousand newspapers nearly two weeks before the Society saw it. Of seventeen members of the New York Section assembled on the night of January 13, only three had seen the report. Only one of these had had an opportunity to read it, and he gained that chance only by obtaining a copy from one of the four thousand papers.

What was the result? Before the Society had been given the opportunity to stand back of the report, an opposition lumber press had been able to put in type bitter attacks against it. Then the Society proceeded to still further muzzle its guns and withhold its ammunition until the

opposition press should be given five additional months of offensive while the Society conducts the referendum that should have been taken before the report was published. Publicity is a two-edged sword, and an immense amount of damage can come from handling it recklessly.

The procedure adopted makes the position of the foresters much more difficult. In President Olmsted's annual address he said that success for a real forestry program could be assured "if foresters as a group" were back of it. But instead of giving "foresters as a group" the leadership of a frontal attack in force, after thorough preparation, there goes forth a little raiding group of nine, and two of these are not wholly prepared to move. One, indeed, thinks that the "support and advice" of the opposing forces "should be sought." The program would be farther ahead today if his suggestion had been even less drastic and had read that "the support and advice of the foresters should be sought before proposing it to the public."

Mr. Olmsted did the Four an injustice in his reference to their "attempt to suppress the Pinchot report." What they sought was "the free and open discussion" by which Mr. Pinchot subsequently stated the question was going to be settled. It is free enough and open enough to the lumbering interests who have complete copies of the maps and orders of the campaign, which the Society, by its own action, cannot use for some time. The effort of the Four was to get that free and open discussion. They wanted the report widely spread, but after the Society had been given the chance to back it.

Mr. Pinchot said, in closing his plea for the report, that he was sure of the support of the Society of American Foresters "after it has made up its mind." Just so! But some members of the Society object to the idea of having its mind made up for it by a propaganda through the press, instead of through its own efforts to arrive at the truth in its own way.

The Chamber of Commerce of the United States has for many years submitted every large question to an entire referendum of its membership. It has never issued a pronouncement on questions of policy except through the results of such a referendum; and it has never found the method too difficult or too long-delayed on any point at issue.

It will be noted that this paper contains no criticism of the report; nor does the writer now offer any. It is a condemnation of methods. It is an effort to give the writer's answer to that plea of officers and committees for guidance in respect to "a similar situation in the future, should it arise."

A SECOND PLEA FOR ASSERTION

BY RALPH C. HAWLEY

This plea is made after reading "A Plea for Adjustment," written by Ernest A. Sterling, of James D. Lacey & Co., and published in the November (1919) JOURNAL OF FORESTRY, and "A Plea for Assertion," written by the President of the Society of American Foresters, F. E. Olmsted, in the May (1919) JOURNAL OF FORESTRY. The apparent intent of the former article is to discredit the main idea advanced in the latter, namely, that foresters should become more aggressive and assert themselves more vigorously.

There is enough merit in Mr. Olmsted's idea so that without subscribing to all statements in his article it seems, for a forester, preferable to the "mental adjustment" apparently secured and favored by Mr. Sterling.

The greater aggressiveness which should characterize the forester's attitude may well find expression in setting forth bald facts concerning and the distinctions existing between the *business of forestry* (producing and marketing tree crops) and the *business of the lumber industry* (marketing and manufacturing tree crops). This will include bringing out strongly the economic truth that forestry is a practical business proposition just as much as the various branches of the lumber industry. The difference in interest rate paid, length of investment, and other details do not alter the fact, although it may deter all but special classes of land owners from entering the business of forestry.

More vigorous assertions by foresters should have as their ultimate goal the education of the general public. The public, rather than the lumbermen, have the largest and most permanent interest in the timber resource and will finally determine the broad outlines of our forest policy.

The members of the lumber industry are credited with owning two-fifths of the forest area in the United States. This is a minority holding in respect to area although not in respect to amount of timber. Their holdings, both in area and in amount of timber as a whole, may be expected to decrease. Eventually the present large holders of forest soils either will take up the business of forestry or dispose of their holdings to those who will. This process in the course of time

will work out automatically whether or not any public control over private lands is exercised.

The time has come to show the public that the lumber industry for its permanent prosperity is dependent upon forestry. It is to the advantage of the industry that the public should be more fully informed. There will be little real objection by the clear thinkers among the private land owners to greater assertiveness along this line on the part of the forester.

Mr. Sterling, in his article in the November number referred to above, says: "They" (referring to private land owners) "will welcome foresters in their woods and pay the bill, to exactly the extent that it can be made a business project." In using the phrase "a business project" it might appear that Mr. Sterling had assumed the "mental adjustment" appropriate to the business of lumbering. Forestry can always be made "a business project" when it is desired to engage in the *business of forestry*, instead of the *business of lumbering*. The condition apt to exist is that the owner desires to obtain both the immediate profits of lumbering and the future profits of forestry and finding this impossible terms forestry impractical when the trouble lies with his unwillingness to invest the capital needed to conduct the business of forestry. If any plea for "mental adjustment" is timely (as Mr. Sterling says it is), then it should be a plea that men in the profession of forestry secure and testify to such "mental adjustment" as is consistent with the business of forestry

CO-OPERATION BETWEEN NATIONAL FORESTS AND ADJACENT PRIVATE LANDS

BY BURT P. KIRKLAND

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After nearly a decade of quiescence the profession of forestry again shows signs of life. It is high time, for the decade has seen the near completion of white pine exploitation in the Lake States, while it is now reported that the end is in sight in the southern yellow pine. The pulpwood shortage is becoming acute in certain sections. These phenomena prove the foresight of the foresters who gained the ear of the public in the early years of the present century but were unable to have their recommendations acted upon, except as to the creation of National Forests, which have been well established and protected from fire. Time, therefore, presses, for the introduction of efficient forestry on the National Forests and its rapid extension to private lands. There are many problems to solve which the past decade, though one of inactivity in forestry matters, at least has given sufficiently full time for discussion of policies to show conclusively that there is no one panacea such as tax reform, financial reorganization, better industrial organization, etc., which will solve all forest problems. A complete program must provide all of these in greater or less degree, and in particular must deal with local problems according to local circumstances and needs. Ultimately, the program must provide for getting each forest area into a form of ownership under which continuous forest production is practicable.

The present paper deals with a restricted class of private forest lands, though one of great importance, that adjacent to National Forests. It proposes methods of immediate introduction of forestry on these lands pending the time ownership conditions become settled. Every western forester knows that when the National Forest boundaries were established it was already too late to include many areas which logically belonged within the National Forests, because these areas had already, in whole or in part, passed from public ownership. Such areas lie along the boundaries of the greater part of the National Forests in the important western timber regions. It is with these

lands and, incidentally, the adjoining National Forests, that this paper deals. Just as our forest problems as a whole must be attacked and solved piece by piece and area by area, so intelligent management of the National Forests and adjacent lands depends on treating each of the innumerable natural economic units according to its needs. Failure to do this has been perhaps the chief defect in National Forest policy to date. The adjacent lands to which I refer, cannot be treated as one homogeneous area but must be attacked unit by unit together with the National Forest lands forming part of each unit. Most of these areas may be defined as productive units sufficient in area to support continuously one or more wood-using industrial plants. Usually each unit will consist of a watershed 25,000 acres or more in extent, or a combination of several small watersheds. The lands involved will in each case be hilly or mountainous land, or otherwise unfit for agriculture except in spots. They are essentially commercial forest areas where permanent industry depends on continuous forest production. Frequently some agricultural land lies within or alongside their boundaries. In this case a high type of agriculture depends on proper management of the forest lands, since otherwise the markets for agricultural products will disappear or be too remote, and there will be no alternative employment for labor in seasons between agricultural activity.

Obviously enough, the ultimate ideal in these cases is to get them under unified ownership and management. This end cannot be attained hurriedly, however, and if good management waits on its attainment the forest will disappear from large portions of the area before adequate measures of reforestation and protection can be taken. The sensible course, therefore, is to get the areas under immediate management of the best type possible, and thus begin working at once toward the attainment of the ideal, which can be reached only at a much later period.

Bearing in mind that the areas under discussion consist of economic units, each of which is capable of sustaining a logging operation, saw-mill or other wood-using plant of efficient size in continuous operation indefinitely, I assume it to be axiomatic that each of these areas should be put under regulated sustained annual yield management. It has been abundantly shown in the past that only this type of management will secure the largest product and the greatest financial return from the forest, just as it has also been shown that only under this type of management can the interests of the worker be served through perma-

ment employment under the living conditions possible in the permanent community. The problem, then, is to put an area forming an economic unit of management now partly in National Forest and partly in other ownership under unified sustained annual yield management. Pending the time that the ownership can be transferred in whole to one party or the other, it is obvious that co-operation between the Federal Forest Service and the private owner is requisite if forestry is to result. Since the average private owner is not trained in forestry and does not recognize its benefits to himself or his obligation to keep his land in producing condition, it is plain that the obligation rests squarely on the shoulders of the Forest Service to initiate negotiations in each instance. Failure to do so is failure to protect the public interest with which it is charged, and which demands that all non-agricultural forest lands be kept in producing condition.

The first step, then, is to form a definite workable co-operative agreement between the Forest Service and the timber owner. What are the arguments which the Service representative must rely on to induce the owner to enter into such an agreement? They will vary widely with the locality, but the following will apply nearly everywhere.

(a) Since sustained annual yield management means a continued supply of raw material, the timber operator will be assured of continuous operation of any wood-using industries or plants indefinitely. (Provided proper sales methods are pursued in disposing of the annual cut of timber, as discussed hereafter.) It is very easy to show the operator that continued operation of his plants will eliminate depreciation due to exhaustion of raw materials, which annually necessitates writing off huge capital charges in the lumber industry. Under these conditions the operator can afford to build a permanent, well-equipped plant which will turn out lumber or other wood manufactures with the utmost economy, thus placing the owner in a strong competitive position. This long life of the plant has the strongest possible appeal, especially as in many cases the timber owner knows that it will be a doubtful investment to construct a plant for the amount of timber he has available on his own holdings.

It further follows that since the plant is permanent the community around it, often shaped by the policies of the timber operator, will be permanent. It will, therefore, be possible, if the owner so desires, to establish a permanent townsite properly planned from the industrial and residential standpoint, where permanent homes, schools and churches will be established. This assures the operator a more con-

tented and efficient class of labor and may enable him to realize on property values never created in the shack towns of temporary milling plants. The opportunity to establish a well-balanced, permanent community often possesses a strong appeal for the business man from the altruistic side. There are several examples of this in western Washington, even under the present exploitation system.

(b) Continuous forest production also is an active conservator of value in the timber and timber land itself. Under the timber mine system depreciation must be written off of capital account as fast as the timber is cut. If to be cut in ten years, the annual depreciation charge on the timber investment is 10 per cent. Cutting regulated to what the forest will produce continuously (assuming reforestation) eliminates the item of depreciation entirely in some cases; in others it will remain at a reduced percentage for some years while surplus stock is being reduced; afterward appreciation will set in, due to rising timber prices and growth of young stands. In short, continuous forest production insures the removal of just as high values from the forest at the same time it eliminates depreciation from the forest investment by insuring that productivity will be as great in the future as at the present, whereas destructive lumbering removes all or nearly all value of the forest investment. In cases where all the cutting under a co-operative agreement falls at first on the private lands, just as great a total sum of the timber investment can be written off as under destructive lumbering, but the residual value will be many times greater because young stands being conserved where possible, and regeneration being secured elsewhere, sets the investment to increasing in value and preparing for a future cut at once. Should the timber owner later sell these lands in the only market where they have any value (namely, to a purchaser who will use them for continued forest production), the sum received should be much greater because of their productive condition as compared with lands where the forest has been completely destroyed.

By way of summary, it may be said then that an agreement looking to conservation of producing capacity of forest lands of private owners should be made to appeal because capital is thereby conserved in the timber, in the land, in the mill, and the surrounding community in which the operator is apt to have the chief financial interest.

These inducements will in many cases be insufficient to induce the private owner to co-operate in this voluntary manner if it involves his holding standing timber materially longer than he had planned. This

can be avoided by allowing the private owner to exploit his timber first, the National Forest being allocated to later cutting budgets. This is obviously sound finance, because the Federal Government working under say a 4 per cent interest rate can hold a dollar's worth of timber 25 years for the same interest cost that the private owner working under a 7 per cent rate would incur in less than 15 years. Furthermore, taxes add to the private owner's costs. Since the public must stand most or a large part of the cost of holding the timber, it is advisable to allow the high cost holdings to be cut off first. *No concessions of this type should be made unless the land where the private-owned timber is being cut is to be continued in production* If not, it is more in the public interest to have the private timber remain standing, thus making the area function at least as a storehouse, while at the same time the State benefits through the tax collector. It is clear then that through this policy of cutting or withholding cutting from the National Forest lands forming part of a forest unit such as we have under discussion, the Forest Service possesses in many cases the key to the situation. It can materially increase the value of the private holdings without expense to itself by holding the public timber for future operations of the existing plants. It can decrease the value of the private holdings in many cases without legitimate cause for protest by the private owner by throwing National Forest timber on the open market. It can also hold forth future purchase of the private land as an investment. It is my judgment, therefore, that in innumerable cases the Forest Service can hold forth ample inducements to get the private owner to enter into adequate co-operative agreements which will insure continuous forest production on the forest units concerned, including both public and private lands. If this be true then it is clear duty of the Service to undertake it, because it forms an adequate method of putting a large area adjacent to National Forests under immediate management.

TERMS OF THE CO-OPERATIVE AGREEMENT

Among other details of a more minor nature, the co-operative agreement should provide the following fundamentals.

1. The exterior boundaries of the economic unit, part of which is in private ownership and part in public, should be carefully defined.

2. Fire patrol on the entire unit shall be organized co-operatively; the cost shall be borne pro rata according to the area owned by each party to the agreement.

3. The annual cut on this area shall be limited to what the area will produce continuously, plus or minus such amounts as competent foresters may determine as advisable to remove a surplus or deficiency in the stock.

4. Each owner shall receive the full value of the stumpage cut from its holdings.

5. The place or places where cutting shall begin may be decided in the agreement or left to decision of competent foresters. A large part of the first cutting budgets should frequently be assigned to the private lands if desired by the owners.

6. All areas cut over shall, unless to be used immediately for agricultural or building sites, etc., be reforested naturally or artificially at the expense of the owner.

7. Agreements should be included regarding construction and maintenance of forest improvements.

8. Private co-operators may agree to acquire holdings of private interests not entering into co-operative agreements as fast as this can be done at a profitable figure, and the financial condition of the co-operator permits.

9. Agreements should, if possible, be incorporated regarding the method of sale of the timber.

It is believed that there is nothing in the clauses 1 to 8 that cannot be accomplished under existing law. The only item which, seemingly, might be questioned is agreement on limitation of the annual cut. Inasmuch as the Secretary of Agriculture can limit the cut, under regulation S-2, this purpose can be attained in any case, whether incorporated in the co-operative agreement or not. Fire protection is already frequently handled by similar co-operative agreements. It may, in short, be said that the plans here contemplated involve no very new principles in so far as ordinary administration, protection and improvement of the forest is concerned. In one respect only does some difficulty arise in the administration of a co-operative forest unit as here discussed, namely, in the disposal of the timber without undue recognition of the principle of private monopoly. At some time in the future this may be solved by the creation of a public corporation like the Emergency Fleet Corporation, which will have authority to purchase and manufacture National Forest stumpage and perhaps stumpage from certain other sources, including that worked under such co-operative agreements as here discussed. As our present effort is to devise a plan for immediate operation, it will be necessary to work

under existing legislation, and in most cases under existing regulations. This can be accomplished under any one of several plans, of which one may be best adapted to one case, another somewhere else. Under all plans it will usually be best to have exploitation carried on by a separate corporation, which shall pay for public-owned and private-owned stumpage of equal value at like rates. Any one of the following plans of sale to the manufacturing corporation can then be used.

Plan 1.—Sell the amount determined as a conservative annual cut under an ordinary long-term timber sale agreement. A few special clauses may be required to assure distribution of the cut over the whole period. A ten to twenty year contract is here contemplated, with reappraisal of the timber at suitable intervals. The private owner should execute a similar contract to cover sales on like holdings.

Plan 2.—Sell under ordinary timber sale agreement of five years or more duration, but in all contracts, especially the first on the co-operative unit, provide that all mills, camps and other improvements, together with easements for right of way and building sites, shall become the property of the United States (or the private co-operator) at the expiration of the sale agreement. In future sales the successful bidder shall have the right of using all improvements owned by the Service or private co-operator, either free or under special-use permit, with charges equivalent to say 5 per cent on the appraised value of the properties. The timber sale contract should provide for such use. Each contract should also provide for just what improvements are to be made, with complete plans for them. It is perfectly obvious that under the Forest Service method of timber appraised the costs of these improvements will appear as an item of cost in the appraisal, and the stumpage price lessened accordingly in early sales. In later sales the prices will increase because logging and manufacturing improvements are already available. The principal object to be attained by this plan is to maintain complete freedom of competition in bidding for timber without introducing competitive mill construction, as sometimes happens under present methods. Absence of competing mills will relieve the co-operative unit from pressure for over-cutting. On the whole, therefore, this is a very desirable plan, designed to free the Service from charges of recognition of monopoly, avoid the waste of competitive mill construction, while at the same time the annual cut can be restricted to any desired proportions, and the limitations adhered to. It should also prove fairly acceptable to the private owner

of stumpage, as it should insure him the highest market price. Seemingly both of these foregoing plans can be carried out under existing regulations.

It is probable, however, that more fundamental changes in timber-sale methods will in many cases get better results. In view of the trend of methods of timber sale appraisal toward securing the services of capital and private initiative in the manufacture of timber at the lowest rates, the writer has long believed that better results could be secured by more direct methods than the present cumbersome ones, the chief defect of which is the failure to eliminate unnecessary risk from the timber enterprise. Where risk is not eliminated the wages of capital must always be high in order to secure its use. Plan 3 is designed to meet the requirements either of a unit of regulation wholly in the National Forest or a co-operative unit. It is further designed to preserve individual initiative at the same time that capital for forest utilization is secured on the best terms.

Plan 3.—The fundamentals of this plan are as follows:

1. A base price not too high is fixed for the stumpage commensurate to the value in each case; for example, in a Douglas fir sale, \$2 per thousand.

2. A base interest rate, say 6 per cent, is fixed, more than which the timber owner is not permitted to make on his capital so long as he pays no more than the base stumpage price.

3. Premium for efficiency in management is secured as follows: Whenever the annual audit shows earnings in excess of the amount necessary to pay 6 per cent on the investment, they may be added to surplus to cover lean years in future, or they may be distributed between the stumpage owner (Forest Service or private co-operator) and the mill operator in the following proportion: For every 25 cents per thousand additional paid for stumpage the operator may take one-half per cent additional for his capital investment. (These figures are merely suggestive.)

4. All accounting shall be under a uniform standard system prescribed by the Forest Service, and the account shall be audited by Service experts at frequent intervals.

5. Only reasonable salaries shall be paid to executives and employees, and dividends shall be paid only after annual audit by the Service representative.

The essential factor in this plan is to hold the base price to moderate figures and the base interest rate as low as possible. If the base

stumpage rate is moderately low market risks are largely eliminated and errors in appraisal obviated. Under these conditions capital will enlist at low interest rates. The premium given for efficiency, however, will insure economy and full enlistment of individual initiative in the manufacturing process. This form of contract will be especially adapted to continuous production forest because with a moderate base stumpage price manufacturing can go on uninterrupted through ordinary market fluctuations. This will give continuous employment to labor and attain what should be one of the main objects of forest management, namely, protection of the human factor. Opinion will be divided as to the effect on the industry in general. It is obvious that lumber manufacture will go on, good times or bad. If manufacturing units coupled with continuous production forest are organized so as to be in a strong competitive position, then so much faster will all forests be so organized. Moreover, since competition is the fetish of a large part of the American people, no objection can be made to its perfect working.

In some cases none of these plans may meet the needs of the private co-operator who owns his own manufacturing plants. In such cases it may be necessary to include a clause in the co-operative agreement permitting his withdrawal in case he is the unsuccessful bidder when National Forest timber is up for sale, which would very seldom be the case.

It is contemplated, as heretofore stated, in all of these plans that manufacturing will usually be carried on by a separate corporation, which may or may not be financed by the private co-operator. Sales to the manufacturing corporation will be made by the Forest Service covering National Forest timber, and the private co-operator usually on the same terms.

In the foregoing I have sketched in outline form suggestions for co-operation between the Forest Service and adjacent owners for the complete management according to the economic conditions of the locality of forest units not yet in unified ownership. In closing I desire to say that where complete co-operation is not yet possible, then the co-operative agreement should cover as much as the present feeling of the private owners involved in each case will accept. If the Service displays genius in this respect, and wins the confidence of private owners, functions will be added to the co-operative agreement from time to time in somewhat the following order:

1. The co-operative agreement will cover only fire protection of mature timber, as exemplified by many existing agreements in Idaho and elsewhere.

2. Protection of young growth added.

3. Protection against trespass.

4. Grazing co-operation.

5. Co-operation in general administration and in making timber sales, so as to secure better utilization.

6. Establishment of annual cutting budget, such as the unit will bear continuously, even though the private lands are allotted most of the budget. (Some may question putting this ahead of the next item. The writer holds, however, that without limitation of the cut, the forest will soon be destroyed as a revenue producer until after the lapse of a half century or more, in which period the private co-operator will lose interest at the outset and leave his lands to lie waste, prey to annual fires which will spread without let to the National Forest lands. Regulated yield with annual income is an absolute prerequisite to retention of interest by individual or corporate owner.)

7. Planning of cuttings to secure natural regeneration.

8. Co-operation in the disposal of timber with a view to keeping industry permanent in the locality; National Forest timber and private timber being cut with due reference to each other.

9. Gradual addition of artificial regeneration, thinnings where needed, etc.

10. Ultimate unification of the ownership in hands of one co-operative party or the other. (In the majority of instances going to a public owner.)

No matter how few or short the stops along this road of co-operation, I believe the service performed by it can be large, through the ideal of continuous production it will hold before the forest owners and public of each locality. With this ideal before them the importance of young forest growth and its protection from fire can hardly fail to impress some part of the people, at least.

Naturally, many difficulties will occur in carrying out such a program, and many obstacles will have to be surmounted. The writer refuses, however, to contemplate that the splendid forest-producing lands adjacent to National Forests of this region will be allowed to deteriorate to waste lands. It is also unthinkable that the accident of a poorly-framed land policy, resulting in divided ownership of economic forest units should result in permanent divided management

and utilization, with the high costs incident to them. Ultimately these lands will be managed for continuous production as natural units. That day can be hastened by conscious effort. A policy of purchase will take a half century for full fruition, during which time the lands will have been laid waste, thus necessitating expensive reclamation instead of profitable continuous production that is now open to choice. Therefore, co-operation under the wise and patient guidance of the Forest Service is, in my judgment, the only quick solution. Bearing in mind the fact that the best timberlands we have in Washington and Oregon are immediately adjacent to the National Forests, most of the others already having been cut over, the urgency of this movement is very apparent. General success of such a movement will, moreover, be of the utmost service, since it will bring under forest management an additional area nearly, if not quite, as large as the heavy-timbered portions of National Forests in these States. This is true because of the enormous percentage of rough, worthless land in the forests themselves, whereas these adjacent lands are largely first quality forest soil, although too hilly to be of agricultural character. Since the area affected is so large, the profession must hold the Forest Service responsible for undertaking extension of forestry over it.

In affirming that there are no insurmountable obstructions to such a program, I must insert certain provisos regarding the qualifications the forestry profession and the Forest Service must have if such a program be successful. The requirements are:

1. Foresters must have faith in forestry and in themselves.
2. The Forest Service must have faith in forestry. Its leaders in particular should possess the burning zeal of the crusader for the cause of forestry.
3. We must discontinue trying to handle the National Forest area as one unit. The Washington office in particular must discontinue thinking of the National Forest as a large green blur on the western landscape, all to receive the same (absent) treatment from Washington to Arizona. It must realize that the National Forests are made up of innumerable units, each differing from every other in details. It must, further, concede that it cannot know all these details, but must have field men who do know them and are competent to act on their information. It must then set free the initiative of these field men and let them act within broad regulations and subject to inspection *in the field*.
4. Under the foregoing conditions, and under fair salary treatment, we can expect the employees of the Service to show their old loyalty and enthusiasm, with the aid of which forestry will go forward to great advances in the period now beginning.

DETERMINING THE KILL FACTOR FOR BLACKTAIL DEER IN THE SOUTHWEST

BY ALDO LEOPOLD

Assistant District Forester, U. S. Forest Service

In the regulation of cattle grazing on the National Forests, when there is no opportunity actually to count the cattle, the Forest Service makes use of a formula to determine the probable number of grown animals on the range. This formula is based on one or both of two factors known as the "calf-tally factor" and the "steer factor," respectively. The formula is as follows: *The number of grown cattle is equal to three times the number of calves branded annually, or six times the number of steers sold annually.*

The formula is, of course, derived empirically, and the two factors used hold good only under normal conditions. For an especially good breeding range, or after an abnormally close gathering, or where predatory animals destructive to young stock are absent, or where heifers have been sold, the factors must be lowered. Under the reverse conditions, the factors must be raised. Nevertheless the formula, when used with good judgment, has been found workable and accurate enough to be accepted by both stockmen and Forest Service officers as a satisfactory basis for allotting range privileges, paying grazing fees, and removing natural increase from the range.

Broadly speaking, the steer factor is an index of the productive capacity of the herd. In a previous article,¹ an argument was advanced, and I think established, to the effect that the first step toward efficient management of big game on the National Forests must consist of a quantitative regulation of the annual kill. In other words, the kill must be limited to the productive capacity of the herd. If the steer factor is a satisfactory index to the productive capacity of a herd of cattle, why may not a similar factor—a kill factor—be determined to serve as an index to the productive capacity of a herd of game?

This question has been asked and debated for four years by the men in charge of game management in the Southwestern District, and steps

¹ "Forestry and Game Conservation," JOURNAL OF FORESTRY, April, 1918.

are now under way to determine the kill factor for blacktail deer under southwestern conditions. The purpose of this article is to outline and discuss the methods which are being used.

In the first place, it may not come amiss accurately to define the term "kill factor." The kill factor is the ratio existing between the number of breeding animals on the range and the number that may annually be killed without decreasing the breeding stock. In short, it is the ratio between the game census and the annual kill. It has a different value for each species and each locality. It automatically takes into account all normal factors bearing on the productive capacity of the herd, such as secret, illegal killing, predatory animals, cripples, starvation, and disease. On account of the polygamous nature of most big game, the consequent destructiveness of killing females, and the now almost universal prevalence of "buck laws," the kill factor is premised on an annual kill of males only. The kill factor is, of course, roughly analagous to the annual increment as that term is used in connection with the forester's regulation of cut.

In the second place, it is to be kept in mind that the kill factor not only should serve to determine the allowable annual kill from a given herd on which we have a census but, likewise, should serve to give us a census of a herd that has successfully sustained a known annual kill. In other words, census times kill factor equals annual kill, and annual kill divided by kill factor equals census. The steer factor also is used in this way.

So much for the wherefore of the kill factor, its definition, and its mathematical relations. Now we come to the important point: How is it to be determined? For years past each forest ranger has been required to submit annually an estimate of the big game killed on his district. In this vast accumulation of figures, assuming that the breeding herds have held their own, we should have some very valuable figures on the actual annual kill. But these figures are mere estimates made by a large and changing personnel. Presumably, the errors they contain should be compensating errors. An examination of the records in District 3, however, indicates that they are mostly too rough to be usable. During recent years, some of the districts also have been accumulating data on a game census. Some of these figures, for reasons not relevant here, are unreliable, but others are comparatively accurate. Where these good figures on a census exist, and where the herds have held their own, it ought to be possible to take the more

carefully compiled parts of the annual kill estimates, divide them by the census, and determine a very rough kill factor.

The tentative figures show an average kill factor to date of about 1:10 or 1:15. Do these figures seem reasonable? I think they do. The usual steer factor is 1:6. This means that, under present conditions, cattle have a higher productive capacity than deer. It takes longer to produce a killable buck than a steer; consequently the mortality during immaturity must be higher. The fawns are preferred by lions, and the calves by wolves. In general, the wolves have been better controlled than the lions. A last and most important consideration is that the deer herds have long been decimated to a point where they are laboring against what may be called a *lowered specific resistance*. The lowered productivity of a decimated species is a fact so well known and so often and tragically illustrated that it needs no comment here. It is, therefore, reasonable to expect that, under present conditions, the kill factor for deer will be lower than the steer factor.

The kill factor to be arrived at from the statistical records so far described will necessarily be a general one, determined by extensive methods. It has seemed advisable, on account of the varying conditions in the Southwestern District, to institute a series of intensive local experiments in which the same methods will be applied with a much higher degree of accuracy to small areas or "sample plots." The first of this series has just been initiated on the Magdalena Division of the Datil National Forest.

The Magdalena Division is surrounded by open plains, thus obviating seasonal drift, which might destroy the value of the results. It is not much used as a hunting ground by tourists, thus obviating large fluctuations in the annual kill, excessive crippling, and much difficulty in obtaining accurate figures of the game killed. The resident stockmen are anxious to co-operate both in obtaining an annual census and in keeping a record of the game killed. Special tally books have been furnished each ranch headquarters for this purpose. Predatory animal conditions are normal; that is, they are bad. The Magdalena Mountains are an oak country, and sudden loss through starvation is improbable. They contain only blacktail deer, thus obviating the confusion that might arise out of the difference that doubtless exists in the productive capacity of blacktail and whitetail deer. The area is small (99,360 acres), and the present census figure is 50 head. Carefully collected figures on census and annual kill are to be obtained for the next five years at least. The district ranger has charge of the

experiment. Similar intensive check experiments are about to be started at suitable points throughout the Southwestern Forests. When they are concluded, it is believed the Forest Service will have the necessary data for fixing a limitation of annual kill for any game unit in the Southwest, provided a reliable census has been arrived at in the meantime. Methods of obtaining a game census will be treated in a separate article.

It will readily be apparent that the methods outlined in this paper are merely an adaptation of methods known to every scientific man, while the principle of sustained production, toward the practice of which the whole proposed system of game management is aimed, is borrowed directly from forestry. It may, therefore, not come amiss to ask, inasmuch as they have been in charge of the National Forests for over ten years, why foresters have not long ago tried to apply the principles of forestry to game management? As has been shown in the previous article already referred to, and as will be shown in more detail in subsequent articles, this may be done without interfering in the least with the authority of the several States. State game officials are generally without scientific training, and, if we are going to wait for them to initiate a system of scientific game administration on the Forest we are supposed to administer, we are going to wait a long time and reflect scant credit upon the profession by our delay.

EARLY ARIZONA PROBLEMS

BY THEODORE S. WOOLSEY, JR.

The other day I happened upon some correspondence in my personal files with Fred S. Breen, Supervisor of the Coconino Forest, during that interesting period of Forest Service administrative development in 1906 and 1907, when the main problems confronting the executive officer were "personnel" organization, dealing with the public, and the development of policy and procedure.

In April, 1906, a large sale to a lumber company had been negotiated by "O" and "B" at a price of \$2.50 per thousand feet board measure. When the sale began in October, 1905, the contract had not been drawn up and signed. In April, 1906, Mr. Breen wrote:

" . . . The contract came back. . . . I do not see anything covering seed trees, though, as near as I can figure out, we might save what we need, though there might be some agreement verbally to the effect that they were to have all trees 16 inches and over. . . . "

This is typical of the doubt which often arose in the administration of the first sales on National Forests, regarding the stipulations which governed cutting. All this, of course, is now a thing of the past. Contracts are drawn up and fully explained before cutting begins, and it is rarely, if ever, that misunderstandings arise.

Further on, Breen wrote:

"I have written 'P' relative to keeping sheep off logged-over sections; 'D' re. clearing right of way and permission to burn off homesteads outside the 250-foot right of way clearing."

Perhaps this is the first reference in Forest Service administration relative to the restriction of sheep grazing during and directly after the logging of timber as well as the clearing of railroad rights of way for fire protection. Evidently April was a wet month in 1906, for Breen concludes:

NOTE: Permission to publish extracts from his personal letters was obtained from Mr. Breen in December, 1915; he kindly agreed to publication on my representation that his letters contained much of historical interest. In 1906 Breen had charge of what is now the Coconino, Tusayan, Sitgreaves, Apache, and Tonto National Forests.

"Had a bad time getting out to the road on the prairie. Had my horse down a half-dozen times and it certainly looked as though I was up against it for a while."

The local forest assistant, who had charge of this sale, in commenting on the contract, stated in a letter to Mr. Breen, dated March 29:

"I never know when some new piece of finesse in methods is to be sprung. The latest is that the original contract has been changed to include the reserving of seed trees, and . . . to include trees of any size needed for seed. That man 'L' (the superintendent) says it is the first time he had heard of it and asserts the company bought all trees (which are accessible and desirable) over 16 inches and that his instructions from 'D' are to cut any large trees unmarked, and that he would take up the matter with Washington."

After local negotiations with the company and correspondence with Washington, the dispute was finally settled amicably by saving large "blackjack" for seed. This, I believe, was the first departure from the diameter-limit system in the history of the Forest Service.

In August, 1906, the writer was in Washington, and Breen wrote. August 4:

" . . . 'D' informed me that our scale was two per cent higher than his and failed to say it was caused by the inexperience of our scalers—this gives me a small bunch of hopes that he will eventually forget to say it."

When the history of the Forest Service timber sales is finally written, the troubles due to the inexperience of the early scalers will fill no small page, and, in the case of at least some companies, these scalers were offered temptations which, happily, they avoided.

Breen wrote in this same letter:

" 'S', poor red-headed knot-hole examiner, is having a spasm now. He wanted to pay the company \$4 for rent of his house and 'L' tore up his check; then he is having trouble to find out whether he is Henry William 'S' from the Navy Department (which discharge affects his C. & S. exam.). I suppose his wife is anxious about it, too, on account of their child. I will take him up a lump of ice soon. He moved back to town on account of a few thousand skunks that tainted the atmosphere at his happy home and because of the check."

When the Forest Service first took over the administrative force, organized by the General Land Office, it was exceedingly difficult to make promotions correctly. The best that could be done was to have reports from traveling inspectors as to how they sized up the different men. It was natural that mistakes were made.

"'J' was given \$1,100 raise and 'B' \$1,000. I suppose that is because 'B' has been in the Service longer. As I expected, the other rangers all feel hostile. 'P' wanted to quit and go with the S. F. R. R., and the rest of the old men are looking around for something else to do. For a bunch of organized dis-organizers I think the present bunch handling that kind of work skin anything that ever bellied up to a refreshment stand. If they only had savey enough to let things alone until all ends could be considered they would have saved me several yards of unnecessary trouble."

Further on, in the same letter, Breen alludes to the same timber sale:

"The sale has not had time to tangle up any yet. 'A' seems to want to learn things, and I have tried to fix it up with 'N' and the boys so that I don't think anything will happen, as he agreed with me that things should run as they were."

Evidently administrative worries were having their effect on Breen, for he states:

"The only thing I would really want to get away from here for would be to dump this danged job onto someone else and get away from it long enough to get a free breath from old troubles."

In those days there were no deputy supervisors and a man had to be on the job continuously, unless he had an extra capable clerk, or a ranger sufficiently developed to act as supervisor during his absence.

In closing:

"'DuB' wrote me that 'P' had gone to Europe. I think when he comes back that there should be a stirring up of dry bones, and think the clouds will have accumulated sufficiently by that time for him to see them hanging around on the horizon. It does sort of seem to make a fellow sore to think what could be done instead of what is done with all the show they have to make good."

On August 29, 1906, Breen continued to have rather a gloomy outlook:

"While I want to be square with this department and accomplish all that can be according to my lights and also that I appreciate good friendship, but I don't give a damn much, after all the rows and tribulations I have had here to keep things going along some old way and not make the Service ridiculous and a reproach, what they do. Sometime in the future, when they discover more, they may not be so durned fanatically enthused over things, realize it don't pay to rip up their garments quick. I believe that they are all square, with a very few exceptions, and until they discover the details that come in contact direct with the dear people are some harrowing . . . they do not fully realize what all they are up against. . . . I just heard of a conversation between a couple of sheep men that illustrates. One said: 'Oh, hell! "G" will go to "P" and he'll get what he wants; you can't down him.'"

This gloomy outlook was undoubtedly due to the large number of administrative changes which were being made in the interest of improved administration, but which made it exceedingly difficult to deal with the public (particularly in grazing matters) which were as yet unaccustomed to these innovations, nor had the Forest Service learned certain weaknesses common to the western sheep and cattle growers.

In the same letter Breen stated:

"I had considerable of a visit from Inspector 'B' for a couple of days. He took the blame for the mixup in rangers' salaries and from his explanation, I could see how I could have made the same mistake. Whatever 'B' knows, it makes a fellow feel better to have some one like him come along and I believe he is a very good sort of a fellow."

Evidently the disputes, as to scale were being straightened out.

"Old 'D' was in today and said the scale was all right, that they only got a little the worst of it, but were satisfied in a general way. Think of that for a revolution!"

One of the causes of the early friction with "D" was the rule that the amount allowed for defect must be written in crayon on the large end of each log. Since the scale is really an average for a large number of logs, it is inevitable that mistakes should be made here and there, which the timbermen can pick up and grumble over. This order was reversed within a few months of its inception.

Evidently Breen was not satisfied with his rangers, for he wrote:

"I have not had a chance to take up the 'H' matter. . . . He has had his last chance to make good and I am about convinced that he is no good all round. 'D' was no good; he resigned. 'L' of the Black Mesa I fired. 'S' of the Grand Canyon I suspended and asked for his dismissal; allowed 600 head of cattle to pass for 300 all last season; too lazy to look them up. Guess I'm getting sort of peevish and won't stand quite as much as I used to. Too busy to bother with damn fools and them air kind. . . . Don't worry about me. I honestly think it would be a great relief either to get fired or quit."

The next day Breen wrote:

"If my letter of yesterday was some gloomy, forget it. Have had troubles of my own. . . . Have a tree planter here. Am going to start a nursery up near the city reservoir. So will now talk to him."

From an undated letter, presumably in October, or the end of September, 1906, it is evident that the timber sales were not going as smoothly as might be desired.

" 'S' had all sorts of trouble at Camp Three with Charlie, who eventually scared him out of camp. I made him admit that he was afraid of his life if he went back there. Then changed him to Camp No. 2, and sent 'B' back to 3 temporarily. Sent Rube 'N' over to Camp 3 to learn scaling and asked 'N' to teach him at that camp. Changed 'J' to Camp 2 and sent 'H' to take his place. If there is any more trouble it is going to be all over for that bunch of Swedes. They both have instructions not to start anything, but to complete all things started and they are the team that will sure pour some sort of oil on troubled waters in that Swede community or be shipped back to the office in a box."

It is hard for present-day timber-sale administrators to visualize such a situation as this implies and I believe it was very unusual even during the pioneer days; probably the seriousness was considerably exaggerated.

In commenting on the salary problems Breen evidently felt that the rangers were not receiving enough; a feeling fully justified by subsequent salary developments in the Forest Service.

"If a man is well paid, he takes his medicine and it is more satisfactory in dealing it out to him than when all hands are dissatisfied, as at present. You see while you were here you did not go and get a full view of what the boys are up against on the range, but you did at the camps. Another thing, too, it is owing to what men have been doing whether they like scaling or not. I can get scalers when I set out to hire that kind exclusively and there is no kick. The other kind were broke in for a different purpose, and, naturally, kick on figures if it can be avoided. I can shift when I want to when I have men on equal salaries and am not tied up every time something happens."

Evidently Breen was not wholly in accord with my taking up certain matters in Washington, for he wrote in the same letter:

"I should give you merry hell for butting in on the 'S' railway and things like that, but I will pass it up this once. If we get more technical than we are now, it's me back to the old grazing grounds . . . my system . . . is pestered now with so many new and queer ideas that are sprouting that I will soon have to bust out. . . . Well, be good and don't get hasty and jump at anything."

In November, 1906, Breen was detailed to Washington as a district forester to handle correspondence under a chief district forester. During his absence, I held down the Coconino. Naturally I was very green and was tremendously benefitted by Breen's assistance at the Washington end. One of the first problems he assisted in was to cancel the instructions to supervisors, that purchasers be given an itemized scale for each sawlog. On November 26 Breen wrote:

"Am holding up your instructions to give itemized scale. Have stepped it up to 'G. P.' 'X' promised it to 'D' and 'S' sort of agreed with him. I argued the case before 'G. P.' against 'X' and 'S' last week and 'G. P.' said he wanted to hear more before deciding the case. Guess I'll get 'em next time. Wasn't loaded heavy enough."

Breen evidently feared that I would commit the office in regard to grazing details. His advice is illuminating:

"Don't promise a durned scoundrel a durned thing like . . . Tell them what conditions are; what the prospect is, but never let them nail you down. Too many things are liable to happen: if a change is absolutely necessary, that would not give them what you promised. They never get over being mad. It looks as though it would be easy for them to get a permit for 1,000 head of cattle and that is all I would tell them or any one else in a similar deal."

On December 6:

"Inspectors are now meeting and I believe the promotions will most all be made and that even guards will get the \$75 per month before examination . . . I'm sort of jumping all ways now. Inspectors' meeting mornings and trying to keep up current work afternoons. Think all things possible will be shuffled over to the supervisors in the field for them to do. I squelched the itemized scale—inspectors all decided with me, so it don't go. I am hammering on 'B' on the Greenlaw scale and he is with me on the full scale as it stands. It may go through if he has his way. All officers on reserve except inspectors are going to be put under the supervisor. Am on a commission to reduce all supplies and forms to the least possible number. . . . Guess if any more comes up I will have to split up and work in sections."

On December 13 Breen evidently did not find things to his liking, for he wrote:

"Kids! Kids! Kids! Some day they may grow up, but some of them never will. Been trying to hunt up something to soak you on officially, but have not found it yet, so look out."

In his letter of December 19, Breen gives additional advice in regard to grazing permits:

"First, don't pay any attention to promises any one claims that I made—you know what my attitude is concerning promises and you will make no mistake by not considering them, for while I advised them of what might be, I have also plainly said that no promises of anything *went*. That is . . . If I had made any would have told you. . . . 'L. E. B.' will have to take his chances like the rest on the actual standing. That was my agreement. He was to take what was rightfully his just like in all other cases."

In the same letter Breen proceeds in somewhat lighter vein:

"Just saw 'C' who said you were getting along fine. . . . Gee! Wish you would kill the damn cats. I don't want them around and it will be O.K. . . . Got to work. Inspectors are tearing up Use Book horribly. Will be ready for supervisors about May 1, as it looks now."

In a postscript in the same letter Breen evidently did not feel full confidence in some of his men, for he says:

"Black Mesa men you mention are not all standard quality but it is hard country to get good men to come into and stay. Am gradually trying to get good ones. I may some day."

On December 30, it appeared that the revision of the Use Book was still being considered:

"The Use Book is being all shot to hell and nearly everything is being loaded onto the supervisors. They are all to be made disbursing agents and have all money orders and drafts come through their offices, to sell 500,000 feet of timber, grant all special permits except large irrigation projects and power lines. I do not remember just what all else, but they certainly have a job unloaded on them and it will bust the backs of a lot of them. It will take a better class of men than we have or will get at present salaries to do the work."

Alluding to personnel problems in a letter dated January 1, 1901:

"If 'T' don't make good after a square deal, soak him, but always be sure you have good ground. You had better, if you think we'll need the men, ask for what you want over what your allotment calls for. . . . I was thinking that a couple of new men might be needed on the Greenlaw sale, even after we get done with the forest assistants who are on the job now."

On December 10 Breen still seemed worried about grazing complications:

"I would be careful and not say anything about what is intended or what might happen, or anything else, so 'G,' his agents, or any other of the sheep men, can get hold of it to think over and hunt up arguments and stir up rows over. It don't make a danged bit of difference how honest a man intends being with them—that is not especially what they want—it is an opportunity to raise a row and gain some individual advantage by it. That is their system. Honesty don't appeal to them except when it happens to come their way. I don't think you realize yet how danged onery they can be when they think they have found something to howl about. 'G' will never let up. When it comes to a showdown with him, I am sure going to give him his full day in court and a week if necessary, and it is going to be a ceremonial affair with several witnesses and a stenographer. He knows he is a liar when he says he had no day in court. . . . Undoubtedly something will have to be done to prevent a monopoly of sheep and there's the rub. I am convinced that 'T' have more

than their share, that is . . . at least, but a good deal is a sort of money interest, where his name does not appear. The question is how far to go and how to head him off and not allow sheep to accumulate in certain hands. Changes that were made last year are going to be hard to handle. The game for us is to go as far as we can and prove our ground in preventing monopoly, but we can't consistently say a man has no right to borrow money to buy some one out. It may be a legitimate deal and it may be a steal—but there is no sure way of one's knowing what the facts really are. We can guess, but a bad guess raises hell. Will the sheep men howl and all tell you their talk of woe? Get all the information you can but don't say anything they can use and pervert."

Judging from conditions in after years on the Coconino, Breen had a very keen sense of the situation. In 1915 practically 70 per cent of the sheep business in this Forest was controlled by five interests, directly or indirectly. Much the same was true of the cattle industry.

" . . . We must handle grazing better this year and keep closer in touch with their movements. No damage especially was done last year by neglect but they will figure on doing worse this year because we did not hunt them up closer last year."

This is certainly in line with the best practices in modern grazing control. It has been proved necessary to keep in very close touch with sheep in order to get the best results.

Referring to personnel matters and to the recommendations for the Forest allotment for the ensuing fiscal year, Breen wrote on January 31:

" 'S' I skiddoed for you and appointed 'A' as requested. Don't know just where we are at for rangers on the San Francisco Mountains, but think you soaked me in your letter. Also, re. number needed. Good luck to the gang and hope I will see you all smiling soon."

These extracts from personal letters, evidently of much deep-felt sincerity, have tremendous historical value in reflecting conditions during the early Forest movement. Breen's form of expression is forcible and always to the point. From my intimate knowledge of local conditions with which he had to deal, I feel that to his zeal, cleverness, honesty, and knowledge of human character is due much of the early success of the Forest Service in the Southwest. In those days Breen was no mean power in influencing the Washington office and in guiding it over various pitfalls into which it was easy to slip, considering the inexperience of the men in charge. Again and again, and at great personal inconvenience and unpopularity, Breen violently opposed administrative measures which he felt would harm the Service. Of course, he was not infallible, but in my judgment he was usually right.

RATING SCALE FOR FORESTERS

BY CARL M. STEVENS

An effort was made in the spring of 1919 to formulate a rating scale which would be applicable for professional foresters and useable for the administrative positions in the United States Forest Service, the largest body of professional foresters employed in the United States. The result, to date, justifies the conclusion that the start was made along proper lines and that a working nucleus for an effective rating scale was derived.

After testing in a preliminary way the various methods it was possible to get hold of readily, the comparative scheme used by the Army for its officers was adopted as a base. Only the general principle of the Army scheme could be used, however, for, obviously, foresters should be different types of men and rated on different characteristics than Army officers.

The scale in its present stage of development covers only the broad basic administrative positions in the Forest Service. It was compiled for forest rangers and forest supervisors, and all study to the point of presentation has been confined to these. It may, in fact, bear little relation to the more highly specialized positions which deal with technical problems of one kind or another to the more or less complete exclusion of all general considerations and qualifications.

In studying the basic positions the aim was to analyze the position itself and to arrive at a decision as to what would be required in men to ideally fill them. There were determined to be, briefly, five essential qualifications, and these have been used as the main headings in the scale. These five characteristics were then defined in so far as elaboration seemed necessary, bearing in mind that though clearness was required, the scale must not lose its value in a mass of descriptive matter.

If the scale which follows later in this article is studied it will be obvious that the five constituent parts are interdependent and each more or less closely related to the other four. The sum total, as the various headings are weighted, each to the other, analyzes the position, while the scale in its present form calls specific attention to one constituent quality to the immediate exclusion of the other related parts.

The decision on each characteristic must be made as nearly entirely separate as possible from the judgment on each of the other four. By making five separate decisions of each individual in this way the chance of a mistake through over-emphasized minor flaws with disregard of important desirable qualities is lessened. The decision must be based upon the particular characteristic considered, avoiding the mistake of rating too highly in all things a man who is approved of in general, or whom the rating officer may personally like.

The scale has been compiled from what may be termed basic qualities. As far as possible composite characteristics have been excluded from the items which are descriptive of the five main headings. Men should be judged and rated from their actual accomplishment. These results come to mind in nearly every case, primarily as concrete lines of action, either positive or negative. The basic reasons for the action must then be determined by analysis in order that they may be given proper weight in the scale.

The personal and intellectual qualities enumerated under the main heading numbered one are intended to be indicative or suggestive only. These are the essentials which enable an individual to have the true art of handling men. It is clear that any person will have some or all of these qualifications in different degrees entirely. His rating, therefore, is judged on an average as indicated by the results secured and his actual exhibition of the necessary tools with which to work.

The two broad ways in which the art of handling men is of value in Forest Service work are indicated as the main subdivisions under the main head. It is obvious that the two might bear different relations one to the other were entirely different positions to be considered, one compared to the other. In use, however, the scale should be used uniformly over positions of similar type so that this difference in relation may be largely disregarded.

A man is judged, obviously, by the reaction he sets up in his organization and the result secured. It is easy to weigh his ability to inspire and encourage others to their best efforts. If his employees are loyal to him it is indicative of basic characteristics which will assist materially in the grading. Determine, then, whether a man is selfish or generous toward his men and to just what degree this quality is exhibited. These are not the only things to judge by or which will come up, but these and all other items must be reduced to terms of the common denominator indicated by the scale and the whole question decided as a mass judgment.

The phraseology of the second portion of this first heading has been chosen for the particular purpose of including a man's public service relation, broadly speaking, and not narrow the weight of this item to success in serving Forest users. A man's actual altruistic public spiritedness, his influence for progress and his usefulness as a citizen in the community should be determined. In dealing with Forest users and all people a man may be equally courteous, accommodating and diplomatic with comparable benefit to the Forest Service and its larger work.

Caption number two is intended to cover all the training a man has which will be of value to him in his work. No differentiation is made between one kind of knowledge and another if they arrive at the same point or are of comparable value. It is the amount of "know what to do and how to do it" that a man has as professional tools to work with.

Training in Forest Service work, obviously, is not restricted to work actually performed for the United States Forest Service. It is the training, skill and experience a man has acquired in the technique of performance in lines of work which will be of value to him in the Forest Service. It is the sum total of all of these weighed for their respective value which is required. Professional knowledge may be a product of either a forest school course, individual study, or the school of hard knocks in the woods, any one or all combined.

General education is also a broad term and intended to cover educational qualifications for what they mean and produce. It is immaterial whether a man acquired his education in an institution of and for learning, or outside its walls.

It is obvious that the different items under this heading would be required in different weight for the different positions. A supervisor would require a greater degree of training in technical forest management compared to his actual experience in woods work than a ranger where the reverse would be true. A supervisor's experience and training in administrative positions would also be important whereas the qualifications in a ranger would be perhaps of the least importance. General education would be required perhaps in an equal comparative degree in both, but a supervisor would require a different and more extensive type.

There was no attempt, however, to compare the scales one to the other in this way. They were entirely separate and were so considered.

The scale was used to compare men of the same position and the relation between positions left for further consideration.

This caption includes also a general understanding of conservation and forestry principles, an appreciation of what the whole National Forest movement means, and what it is intended to accomplish.

A man may be an extreme specialist, either in training or tendency, to the exclusion of a broad, technical training. In any given position it is the general average of these items which is required, the number and amount of professionally trained tools which a man has.

The subdivisions under number three are intended to be very largely indicative and analytical. Plain, ordinary intelligence, as we all understand the word, is meant. The mental characteristics set out are those inherent in the type of intelligence required. All or any one of them may be present in varying amounts. It is the average sum total exhibited that is required.

Caption number four is given a relatively narrow meaning in order to avoid including too much of the value of other essential qualifications already enumerated. Dynamic or driving force are also indicative of what is intended. It is the action which must combine with a man's professional and organizing skill to get results.

The qualifications enumerated under number five are also indicative. They are subdivided into main heads largely for the purpose of clearly and forcefully setting the different phases up to a man's mind clearly. The purely physical features are an item in forest work, though perhaps of not so great importance in some positions. The other personal characteristics will be found with the physical in varying proportions in different individuals. An average of these is what is wanted in a comparative manner.

The characteristics in men which show most clearly in every day work are the result of certain combinations of basic mental qualities. One can judge easily whether or not any individual is what is called a good office man. This item resolves itself on analysis into several component parts. He is systematic and orderly in every day life. His correspondence is neat with clear and concise expression. This latter is indicative of clear thinking and the ability to express thoughts well. Upon analysis these qualities are readily reducible to terms of intelligence and education or training.

One sees in every day life a man's reaction to matters of policy and to general restrictions or constructive assistance which may be made available. This finally resolves itself to an attitude of mind and

becomes in turn reducible to intelligent and personal qualities as they may have been tempered in his life by training.

A man is found neglectful of duty either in whole or with reference to particular items. This means something which may be balanced and is a definite result which it is possible to judge. It is, however, a composite characteristic in men and is not dependent upon composite basic factors. A man may have poor judgment in weighing the relative importance of one item against the others. He may be lacking in the proper ability to get those under him to help and thus force too much execution upon his own time. Final analysis may show that the man is too closely restricted from above and really is not personally responsible. Thus it will be seen that careful analysis is necessary in order that the item may receive proper consideration in a man and that reduction to terms of a common denomination is necessary for a comparison of the characteristic in different individuals.

There are, literally, hundreds of these composite reactions in every day life and it is by using these one is able to judge men. Care must be taken not to slight the mass at the expense of one or two predominating features. It is for this reason that the basic mental factors have been specifically enumerated in the scale. Decision is reached on this basic common denominator in the last analysis, working either consciously or otherwise back through the complex reactions met in every day life.

In developing the scale by actual use the first step is a complete list by the rating officer of all the individuals he knows in the class of position to be rated. It happened, of course, that nearly all of the rating officers knew men who were not at that time immediately under their supervision or who had actually changed their work entirely. The aim was to have each rating officer cover as broad a field as possible from his own knowledge.

Starting from this point every characteristic of each man in the list except his qualifications under "The art of handling men" was disregarded. The one individual who ranked highest in this regard was chosen. An effort was made to pick the man who was the best typical example in the list and his name was placed first, at the top, in a new check list now forming. In exactly the same way the one who ranks lowest was selected. This name was placed at the bottom of the list. An effort was made to get as nearly the highest and lowest examples within the field of each man's knowledge as possible. Usually this decision was easy. The next step was to select another who graded

between the highest and lowest examples, an average was struck and the man selected placed in the middle position in the list. Another was then selected who graded between the highest and the middle, as nearly an average between the two as possible. This name was placed next the top position in the list. Similarly a man was selected and entered between the middle rank and the lowest.

Each of the other four main headings were treated in a similar manner. The result was five check lists of five men each. Each list represented the highest and lowest examples under the various rating scale captions, with a three-way average between the top and bottom. The averages require a great deal of thought and it sometimes seems that a true average cannot be selected. There is a wide range between the top and bottom of the list and the best man and the poorest are so radically different that an average between the two requires careful thought. In practice, however, this has been determined entirely workable and productive of satisfactory results.

In order to present clearly the entire thought in the work so far accomplished with the scale, it is now necessary to go back, and show, as clearly as possible the manner in which the weights for the various main captions were produced. Obviously, the main caption, No. 1, "The art of handling men," is more important when weighed against the other four in certain positions than in others. It seemed clear that a great deal of thought should be given this by a large number of rating officers and the matter was thoroughly discussed with some forty-odd men. Each set down his opinion and the reasons therefor were carefully thrashed out.

The results which are given below are very nearly an exact average of these opinions, and it is interesting to note in passing that after two or three wild exotics were excluded no one man varied very radically from the average.

For forest rangers in the United States Forest Service the high man in the first check list; that is, with reference to "The art of handling men," was rated 25, the next man 20, the middle 15, next 10, and the low man 5. Each of the other four check lists were graded in a similar manner, as follows:

	<i>Highest</i>	<i>High</i>	<i>Middle</i>	<i>Low</i>	<i>Lowest</i>
2	20	16	12	8	4
3	35	28	21	14	7
4	35	28	21	14	7
5	35	28	21	14	7

Obviously this grades Caption No. 1, "The art of handling men," to Caption No. 2, "Professional knowledge, skill and experience," as 5 is to 4 and so on with all five main headings.

With these weights established and the five check lists ready and weighted, each man in the first gross list prepared is rated. He is compared with the men in the check lists and given a numerical rating, taking the figure set opposite the typical example whom he most nearly represents in each of the five headings separately. If a man seems to fall between two men in the list he is given credit for the number of points between the two which seems equitable. His five figures are then added for his total comparative rating.

Certain of the men will appear as typical examples in one or more of the check lists, in which case they take, of course, the check list figure set against their names.

The result is a list of all the men placed by the rating officer, including his own subordinates, in the first list. These men are rated in their positions from high to low and the figure ratings establishing their relative positions.

THE SCALE

1.—*The Art of Handling Men:*

Self-mastery, justice, dependableness, courage, sympathy, tact, teachableness, understanding of people, firmness, enthusiasm.

(a) Ability and success as an organizer.

(a) Success in serving the public.

2.—*Professional Knowledge—Skill and Experience:*

(a) Training and success in Forest Service work.

1. Silvicultural.

2. Grazing.

3. Lands.

4. Fire, etc.

(b) General education.

3.—*Intelligence:*

(a) Vision, judgment.

(b) Ability to learn and grasp new points of view.

(c) Keen observation, alertness, quickness, analysis, criticism, concentration, memory, practicality, accuracy, initiative, order, teachableness, constructive ability.

4.—*Ability to Execute:*

(a) A piece of assigned work successfully carried out.

(b) Physical and mental energy.

5.—*Personal Qualities:*

- (a) Strength and health, personal appearance, congeniality, personal habits.
- (b) Readiness to shoulder responsibility for his own acts.
- (c) Integrity, loyalty, dependableness, enthusiasm, optimism, courage, prudence, industry, decision, initiative, patience, perseverance, self-control, carefulness, economy, amenableness to reason, aggressiveness, sense of justice, diplomacy.

Though this fairly completes the action and development of the scale to the point of presentation, there are one or two additional items which should be noted as having a general application on future development.

It is clear that for effective general use a relation must be established between rating officers. An effort was made to secure this by requiring that the complete process be prepared. This was not called for in report form but was to be discussed thoroughly with one general personnel officer who would become familiar in this way not only with the men in the positions being rated but with the rating officers themselves. Many of the lists actually used the same men. As these identical individuals were rated by different officers, a relation between the rating officers themselves is established which is of material assistance in determining the relative positions of the individuals whom they rate.

No effort was made to go beyond this point in actual practice though it is obvious that further division of the final list must be made in order to determine the point at which promotions shall be given. It would be possible to do this by rating on a percentage basis to a theoretically perfect example of man for the position being rated. This is not readily workable because it destroys the basic comparative principle. The resultant list may, however, be divided into equal sections—the first or top section to be promoted in a certain manner. The bottom section perhaps no promotion at all, and the intermediate sections to an average degree.

It is interesting to notice in closing that the scale here presented has actually been used in practice. It has not only been productive of results satisfactory to the rating officer in each individual instance, but has actually brought different rating officers together in result where the same list of subordinate personnel was considered separately by the men rating. It is also of interest that as acquaintance with the scale develops the results by different men are increasingly effective and more uniform. The error percentage in any case as between different men was determined almost entirely negligible.

WOMEN AS FOREST GUARDS

BY JOHN D. GUTHRIE

Captain, 310th Engineers, U. S. A., Archangel, Russia

The demands of war made vacant many positions in almost every activity throughout the countries at war. These breaks in the civil and industrial ranks were filled, and in many cases well filled, by women. With the calling to the colors of all the available man-power of France every man that could be spared from the forest personnel went to the front or into some form of war activity, and in many cases women filled the vacant places. The drain upon the forest personnel on the National Forests of the United States was heavy and was alleviated to some extent by the use of men who were not subject to the draft, or were relieved from it, by older men, and, in some cases at least, by the employment, and with apparent success, of women fire lookouts on some of the Federal Forests.

So far as is known by the writer none of these women lookouts were given formal appointments as forest guard by the U. S. Department of Agriculture. Also so far as is known there is no Federal legal restriction prohibiting the formal appointment of a woman as a forest guard, or as forest officer in other grades. With woman suffrage as an eventual certainty we may have some time not only female forest guards but female forest rangers and even supervisors.

I have known of several rangers' wives who were the equals of their ranger husbands in knowledge of forest business and forest regulations and might have proven themselves far more efficient as forest officers than their spouses, had they worn the badge. In early English forest law the position of forester (an officer in charge of a forest—which however was primarily the hunting preserve of the king) was an hereditary one and there were many women who held the position of forester in early England; if I am not mistaken Sherwood Forest at one time in its history had a woman forester—perhaps it was Maid Marian. In France apparently the legal phase of the question of appointing women as forest guards has come up since the war began.

In this connection the following translation¹ of a communication by Ch. Guyot may be of interest to American foresters, dealing although it does almost entirely with the legal side of the question of the employment of women as forest guards in the French forests:

The case of the Widow Rincet. Civil Tribunal of Troyes—session of Oct. 16, 1918.

Communication of M. Emile Maire, former Inspector of Waters and Forests Service:

"The Count of Hunolstein had as a forest guard for his forests situated in the arrondissement of Troyes, M. Rincet, who was mobilized upon the declaration of war, and who died on Oct. 29, 1917, of a malady contracted at the front. During his absence the position of guard had been filled by his wife, a person of intelligence, very familiar with forest management, besides of irreproachable reputation and enjoying the general esteem of the community. After the death of Rincet the manager of the estate of the Count of Hunolstein proposed to the widow that she continue to perform permanently the functions which she had performed temporarily in such a satisfactory manner—which she accepted. It remained to make regular the position by giving her an appointment as private forest guard, by having her accepted in this capacity by the prefect of the Department of the Aube and by her taking an oath before the civil court of the arrondissement.

The appointment, issued on Dec. 18, 1917, was addressed to the prefect with the usual notations (date of birth, certificate of good life and morals, etc.) asking for his approval, which was given, not without some delay. In short, by virtue of this decision, accompanied by the following, the court was asked to allow Madame Rincet to take the oath prescribed by Art. 117, C. for. The court at its session of Oct. 16, 1918, received the oath, at the request of the attorney of the government and Madame Rincet found herself qualified by due verbal process to fulfil the functions a police officer, under the conditions of Art. 188, C. for.

This decision is new and important, especially under the circumstances, where following the departure for the Army of the greater part of the forest guards, forest owners ran the risk of neglect of their forests and were at the mercy of trespassers. Without doubt such considerations led the prefect to welcome the unusual request which was submitted to him. Perhaps he would have hesitated longer had not the owner, very opportunely, been able to cite in support of his request other cases of women being sworn in in other services (for example—in the personnel of the metropolitan railways of Paris). As for the civil court, after verification of the papers presented, it admitted without question the taking of the oath.

¹ Department of Jurisprudence, *Revue des Eaux et Forêts*, Jan. 1, 1919, Pp. 4-5. Private forest guard: female personnel—Art. 117, C. for.

Neither Article 117 C. forestry, nor any text of law prohibits a private owner from giving to a woman a position of safeguarding his forests. The prefect or sous-prefect can validly accept a woman as a private forest guard, and the civil court should accept the oath of this woman; no legal objection can be made to this oath.

We believe that from the legal point of view these decisions should be sustained and that they will serve as a precedent for any future legal action. Nothing in fact, either in Art. 117, C. for. or in the law of 1892, prevents the duties of a forest guard from being performed by a person of the female sex and no reason of inherent incapacity to serve may be brought up in this respect. However, it should be noted that as far as administrative authority is concerned the prefect or sous-prefect exercises a discretionary power, and that consequently he could refuse this authority for reasons of expediency or simple fitness. Such a refusal would not be subject to litigious action for exceeding his authority but to a simple complaint to the proper minister, of higher authority than the prefect, in this case to the Minister of Agriculture. On the other hand if the court refused to admit the oath after the approval of the prefect or the sous-prefect, the reasons for its decision could be made the subject of a litigious action, under the form of an appeal, just as is the case with all judicial decisions."

THE IDENTIFICATION OF MAHOGANY

BY ARTHUR KOEHLER

Forest Products Laboratory, U. S. Forest Service

Considerable information on the characteristics of mahogany and its substitutes has been made available comparatively recently through the efforts of a number of investigators. This was principally an outcome of the war, as this information was needed in connection with the manufacture of airplane propellers. In the January issue of the JOURNAL OF FORESTRY, Professor Record of Yale had a key for identifying some 40 species of mahogany-like woods. An article entitled "Mahogany and the Recognition of Some of the Different Kinds by Microscopic Characteristics," by Professor Henry H. Dixon of Trinity College, Ireland, appeared in the Scientific Proceedings of the Royal Dublin Society for December, 1918. At about the same time the writer prepared for distribution among Government inspectors, officials and manufacturers of mahogany products, a mimeographed article, "The Identification of True Mahogany and Certain So-called Mahoganies."

Record includes 11 species not mentioned in Mell's "True Mahogany" (U. S. D. A. Bul. 474) as being called or similar to *Swietenia mahagoni*, and Dixon adds 19 other species, bringing the total of mahogany-like woods up to 97.

It is with Dixon's paper that this review is principally concerned. The writer wishes to take exception particularly to his definition of mahogany, which follows:

"We may, then, define as mahogany all red or red-brown timbers in which the fibers of adjacent layers cross each other obliquely, and so give rise to a play of light and shade on longitudinal surfaces ('roe'), greatly emphasizing and enhancing the figure. This causes the wood to be difficult to 'clean,' and confers on it a freedom from splitting and warping."

Few woods fit this definition better than red gum except that the gum has a tendency to warp (as have most other woods with interlocked grain, mahogany apparently being an exception). Not many consumers of wood, and probably few dealers and manufacturers,

would agree that any definition of mahogany should be as broad as to include red gum and a host of other woods which are decidedly inferior to mahogany when used in the manufacture of many articles. If the word "mahogany" is to have a meaning of any value it must be restricted in its use to a definite article, and any substitution of other woods under that name, even if they happen to have a similar color, and interlocked grain, should be considered a misrepresentation. If the name of a well-known wood with exceptional qualities is to be used for a number of inferior species, why not do the same with other articles of commerce? Why not call horseflesh "beef," oleo "butter," and mercerized cotton "silk?"

Somewhere else (p. 433) in the article the author temporarily takes a more conservative attitude, for example: "Such differences in the different woods classed as mahogany might be multiplied, and it might seem that either the name mahogany ought to be abandoned altogether and distinct names given to the different timbers now classed under it, or it should be restricted, as Mell suggests, in its use to the wood to which it was originally applied; that is, to the timber derived from *Swietenia mahagoni* and possibly also from *S. macrophylla*." However, he says that either of these alternatives is practical. As objection to the second possibility he states the following, "and its restriction to the timber of the tree from which mahogany was first obtained is also not feasible, for according to Stone, it is even uncertain if any of the timbers now on the market come from *Swietenia mahagoni* L., and certainly most of them do not." This should not, however, be sufficient reason for rejecting Mell's suggestion. Stone evidently was uncertain in his identification of mahogany. He states in *Timbers of Commerce* (p. 32), "The various species of mahogany and so-called cedar are so confusing that I confess to the inability to make any precise statements either as regards their structure or origin." Quite contrary is the statement by Rev. James Aiken, of British Guiana, in "Timehri," "In specimens of local grown timber I have examined I find that the *S. mahagoni* grown here corresponds absolutely in these characters with Stone's description and the specimen he sent me. It is well to emphasize this point that the identity of wood from *S. mahagoni* tree is, judging by specimens of various age I have procured, never in doubt for a moment." The odor of the *Cedrelas* alone is sufficient to distinguish them from true mahogany.

Dixon's key is based largely on microscopic characteristics. In the descriptions of the woods he first cites the origin of his specimens, next

he gives the gross structure and some of the physical properties, and then the microscopic structure of the cross section, tangential section, and radial section.

Particular attention is called to a microscopic feature which is used freely for distinguishing species or groups of woods from each other, but which has been found very unsafe to use in other woods, namely, the height of the rays and the number per unit area. The size and number of rays at any particular point in a tree trunk varies greatly with the rate of growth and nourishment the tree received at that point, and it is only after an exhaustive study of the height and distribution of rays in different parts of the tree trunk and in trees growing under different conditions that this feature can safely be used in identifying species. This applies especially in distinguishing between two such closely related species as *Swietenia mahagoni* and *S. macrophylla* which he separated on this basis in the key. Whether the rays are one, or two, or many cells wide is a more reliable diagnostic feature, and is made use of in several places in the key. The very fine pitting in the vessel walls of true mahogany and closely related species is also a very distinctive characteristic and helps to distinguish these woods from other families, but was not made use of in the key or mentioned in the description.

This paper together with Record's key form a good basis for further investigations on a larger amount of authentic material than is now available.

The author makes the following explanation: "As a considerable time must elapse before anything like a complete collection of mahoganies can be examined, and as there appears to be an immediate need for some method of identifying the more common kinds, I have put together descriptions and illustrations of the structure of the mahoganies which up to the present have been available to me, in the hope that they may be useful as a means of identification, and that they may serve as a beginning of an examination of a more extensive list of woods."

Twenty references and 138 excellent photomicrographs showing cross, radial, and tangential views are included.

PRELIMINARY REPORT ON CHEMICAL WEED CONTROL IN CONIFEROUS NURSERIES

BY P. C. KITCHIN

Forest Assistant, U. S. Forest Service

The weeding of seedbeds and transplant rows is one of the most expensive items in the administration of the Forest Service Nursery at Haugan, Montana. In the case of two year old seedlings, about 7 per cent of the cost is due to weeding. No satisfactory method of weed eradication, except by hand, has been devised for this location. Even in weeding by hand, much injury is done to the seedlings in pulling the weeds. This is especially true with the redtopped sorrel (*Rumex acetosella* L.), which sends out long underground runners, giving rise at frequent intervals to other plants. In removing a medium sized plant of this species from a seedbed, it is no uncommon thing to dislocate the soil for a radius of several feet, the breaking before being completely disengaged from the bed. This practice results in the pulling up of numerous seedlings and the exposure of the roots of others. Some less destructive method is desirable. However, if the weeding of coniferous nurseries is to be successfully accomplished by the use of chemicals, the problem seems to be one of finding a relatively cheap chemical solution which will kill the weeds and not injure the stock or the soil.

Most of the work which has been done in this country has dealt with the killing of weeds by chemical sprays after the plant has attained a considerable size. Apparently, an easier way would be to kill the small seedlings as it emerges from the seed coat in the process of germination. At the Forest Service Nursery at Halsey, Nebraska, the most important secondary factor, following the treatment of the soil for damping off fungi, has been that of weed control. The records for 1912 show that weeding cost only about 29 per cent as much in beds treated with sulphuric acid as it did in those which had undergone no treatment. Copper sulphate and zinc chloride have proven of value in weed control at several nurseries.¹

At the Savenac Nursery some work has been done by E. C. Rogers on the control of damping off fungi in seed beds through the use of

¹Data taken from United States Department of Agriculture Bulletin 453, by C. Hartley and R. Pierce.

TABLE 1—*Kinds of Weeds*

Bed No.	Method of treatment	June grass	Timothy	Sedg	Clover	Firweed	Yarrow	Red top	Sorrel	Lamb's quarter	Borage	Horsetail	Galium	Crucifers	Dandelion	Misc	Coming from roots	Coming from seeds	Total
501	Control	41	1290	10	1448	27	36	348	10	41	1	...	...	1	...	33	25	3261	3286
502	$\frac{3}{16}$ oz. H_2SO_4 per sq. ft.	5	164	18	500	25	5	61	14	2	...	...	...	...	...	11	31	774	805
503	$\frac{1}{16}$ oz. H_2SO_4 per sq. ft.	18	188	11	1390	9	7	85	6	2	...	...	1	...	...	9	14	1712	1726
504	$\frac{5}{16}$ oz. H_2SO_4 per sq. ft.	77	121	15	2280	1	15	181	18	57	4	...	3	...	...	20	20	2772	2792
505	$\frac{1}{16}$ oz. H_2SO_4 per sq. ft.	9	505	4	19	34	11	110	108	...	1	...	...	2	...	6	136	673	809
506	$\frac{1}{16}$ oz. H_2SO_4 per sq. ft.	6	155	6	129	3	4	87	14	5	...	...	...	...	1	18	9	419	428
601	Control	15	278	2	600	24	4	359	36	21	...	...	...	2	...	56	17	1390	1407
602	$\frac{3}{16}$ oz. H_2SO_4 per sq. ft.	5	121	11	49	14	7	112	24	2	...	...	...	...	...	10	24	331	355
603	$\frac{1}{16}$ oz. H_2SO_4 per sq. ft.	10	107	6	112	22	1	109	39	...	...	...	...	1	...	6	26	387	413
604	$\frac{1}{16}$ oz. $ZnCl_2$ per sq. ft. ....	...	5	...	...	7	...	...	...	...	...	...	...	...	...	...	12	...	12
605	$\frac{1}{16}$ oz. $CuSO_4$ per sq. ft. ....	...	50	...	13	5	...	20	1	1	...	...	...	...	...	...	15	75	90
606	$\frac{1}{16}$ oz. H_2CO per sq. ft.	24	172	...	35	43	30	109	45	...	...	...	...	...	...	64	26	557	583

Since germination was not complete until the season of 1917, weed records were taken during that year. At the close of the 1918 field season, bed 604, which had been treated with Zinc Clo., had not produced a weed, and the western white pine seedlings seemed to be in good condition.

NOTE: Beds 501-506, inclusive, were sown in the fall of 1915.

Beds 601-606, inclusive, were sown in the spring of 1916.

Beds marked with an asterisk were treated in the fall of 1915.

Other beds were treated in the spring of 1916.

chemicals. Weed control, as a secondary result, was noted and careful count of the weeds occurring during the field season of 1917 was made. The summary (Table 1) gives the number of weeds of different kinds and the treatment for each bed.

The preceding data were gathered from an experiment which was not intended for purposes of weed control and it is scarcely possible that the distribution of weed seeds and root stocks was equal among the beds devoted to the work. However, the very small number of weeds occurring in the beds treated with zinc and copper salts suggests that these chemicals may be efficient in destroying weeds shortly after germination in this particular type of soil.

Much work has been done in Europe on the relation of zinc and copper salts to plants and soils. Baumann, in 1885, found small amounts of zinc sulphate sufficient to kill a number of common monocotylenous and dicotylenous species but to work no injury to coniferous seedlings, even after they had been seven months in the solution. He also found the chemical much more efficient in poor (mineral) than in rich (organic) soils. Javallier, in 1908, found zinc present in varying amounts in 45 species of plants of over half as many different families, and including cryptogams and phanerogams. He found it particularly abundant, however, in conifers, classing them as "calamines," or zinc plants.

Experimental evidence, collected from the foregoing and other sources, has led to the undertaking of a rather extensive investigation of weed eradication through chemicals at the Savenac Nursery. Seeds of three of the most important weeds, white clover (*Trifolium repens*), timothy (*Phleum pratense*), and red-topped sorrel (*Rumex acetosella*), have been sowed with the seed of western white pine (*Pinus monticola*) in previously steam sterilized soil, and the various plots wet down with different strength solutions of copper sulphate, zinc sulphate, and zinc chloride. In the effort to eliminate error, due to unintentional variations, the installation has been in quadruplicate, making a total of 84 plots upon which to base results.

Since, according to Beal, weed seed has strong vitality and presumably marked holdover tendencies, and the seed of the western white pine is known to hold over one, or even two, seasons before germinating, results of the work may not be available for some time. The planting out of stock grown under these conditions and observations on their appearance for several seasons, together with determinations of the effects of the chemicals on the nursery soil, will be necessary even after a successful weed eradicator is found. Otherwise unforeseen and serious obstacles may appear later and overshadow any good arising out of the easier method of weeding.

FURTHER COMMENT ON "A FORMULA METHOD OF ESTIMATING TIMBER."

BY E. I. TERRY.

I appreciate the criticism of my formula for estimating timber made by Professor Bruce in the October number of the JOURNAL. My study was based entirely upon the western yellow pine of Colorado and I anticipated some criticism from the Pacific Coast along the lines which Bruce has made. I accept without question the validity of his objections but believe that the defects which he points out and which become apparent when applied to very large timber may be corrected without changing the fundamental principle of the formula.

In the first of his two specific criticisms, Bruce takes exception to my statement that for a given species in a given region the ratio between the cubic and board-foot contents of the merchantable stem of each diameter class will be practically constant. He shows by an example that the ratio increases with increasing *length* of the merchantable stem, and that for large trees having a wide range in merchantable height this increase may be considerable. According to my conception of the ratio between board and cubic feet, I would compare the scale of a tree of given size, not, as Bruce does, with the cubic volume of the corresponding cylinder, but with the actual cubic contents of the same merchantable stem. In Bruce's example the ratio of board feet to the cubic foot for a 32-inch five-log tree is 2.73, which appears to me to be extremely low. For the thirty 32-inch yellow pines upon which my computations for that diameter class were based—ranging from 4 to 6 logs, with an average height of 4.5 logs—I found the ratio to be 6.7 board feet to the cubic foot (Table 2, page 418, JOURNAL OF FORESTRY, for April, 1919). I do not, however, deny that for a given diameter the ratio of board to cubic feet will vary with increasing height, but for the Rocky Mountain pine I found the variation to be so slight that it could be neglected without appreciable error.

In his second criticism, Bruce points out that the equation $V = bH$ is the equation of a straight line when b , the board-foot form factor, is constant for each diameter class. It is in all probability true that for a given diameter the increase in volume with increase in merchantable

height is not exactly in that ratio, but here again the error is inappreciable except for timber having a wide height range within each diameter class.

I believe that both the objections raised by Bruce may be met by employing several board-foot form factors for each diameter, say, for every 20 feet of merchantable length or for each log-length. In my article I made the following statement: "Whether this method will give accurate results when applied to the large timber of the Pacific Coast may depend chiefly on whether one merchantable form factor will serve for each diameter class, irrespective of length. If the form factor varies considerably with length, then several values of b for each diameter class would have to be computed."

By using the "short-cut" method of computing the board-foot form factor suggested by Sparhawk in his comment on my article, the time and labor involved in computing such a table of factors will be comparatively slight.

For small to medium-sized timber and for timber where the height is, even roughly, a function of the diameter, I believe that one value of b for each diameter class will give accurate results. My computation of the board-foot form factors for the western yellow pine was based upon 815 trees, rather evenly distributed among the diameter classes from 12 to 36 inches. The total actual scale of these 815 trees is 530,880 board feet. After having computed the board-foot form factors, I worked up the scale of these trees by using the factors and the total length of each diameter class ($V = bH$). The result was 530,580 board feet, or a difference of about one-twentieth of one per cent. That seemed to me to prove at least the theoretical accuracy of the method.

REVIEWS

Las Maderas Argentinas: su Importancia Industrial. Eduardo B. Castro Rosario. 1918. Pp. 345.

The great shortage of shipping during the war, with its resulting falling off in lumber imports and especially with the acute shortage of coal, has brought to public attention the question of the development and proper use of Argentina's great forest wealth. The forest area of the country is given by provinces, with a total of 106,884,400 hectares, or 36 per cent of the total land area. This figure apparently includes all forest soil, whether or not it actually bears merchantable timber, since previous estimates have shown but 13 per cent of the country forested. Development of forest industries has barely begun, except for the exploitation of quebracho. A few wood-using industries, such as manufactures of furniture and fine cabinet work, have been started within the past 25 years, but they have been handicapped by lack of encouragement on the part of the Government and by the idiosyncracies of the consumers, who prefer imported goods merely because accustomed to them. The State now has an opportunity to put forest industry on a stable basis, capable of supplying the entire domestic demand for all products, and of furnishing a large surplus for export. A serious difficulty is the lack of statistical and technical data regarding the character and extent of the forest resources. The purpose of this book is to make available information about the principal commercial trees found in Argentine forests.

For convenience, the species are divided into four groups, according to density of the wood. Very hard woods (density 1.10 to 2.00) include 20 species; hard woods (0.70 to 1.10), 125 species; medium hard woods (0.45 to 0.70), 86 species, and soft woods (0.20 to 0.45), 29 species. For each is given common and botanical name, commercial distribution, a brief silvical description, mechanical properties as far as known, and principal uses. Unfortunately for convenience of reference, no index is provided.

The introductory portion of the book outlines briefly the history of legislation concerning forests, which began with the Spanish, in 1607. Since the establishment of the Republic various administrations have undertaken to regulate cutting of public forests, but for a long time little was accomplished, owing to lack of funds. Since 1911 the Office

of Forests in the Ministry of Agriculture has been gathering data for the preparation of a detailed forest map and land classification of the country; this work is also handicapped by lack of funds as well as by lack of technical personnel.

The present forest law, passed in 1906, is based on these considerations: (1) To prevent destruction of forest resources, it is necessary to assure State protection not only to the forests belonging to the State, but also to those owned by the provinces and by individuals; (2) the Government should encourage culture of trees in regions now treeless, and should establish nurseries for propagation and distribution of species suited to the soil and climate of different localities; (3) forests should be exploited conservatively, and only mature timber should be removed. Under the "Régimen Forestal" come all forest lands of the State, those of such provinces as desire it, and those belonging to municipalities, corporations, or individuals who wish their lands to be so administered. All State forested lands are declared provisional forest reserves until their status can be definitely fixed upon the completion of the forest map and land classification. No timber or other forest product can be taken from these lands except under permit. Pending formulation of definite comprehensive working plans, the more accessible and better known forests may be exploited under provisional plans. Concessions, to run not more than ten years, are made to the highest bidders, with a limit of 10,000 hectares to any one operator. Cutting must be carried on in a way not to injure the forest, according to principles set forth in detail in the contract. Forest products from either State or private forests can be shipped only when accompanied by a license showing that they were legally removed from the forest in which they originated. When artificial reforestation will be required to maintain a forest cover or particular species desired in management, provisions to this effect are included in the contracts.

Forest fires have been and still are very widespread and destructive, and because of lack of funds, together with the shortage of personnel, the difficulty of transportation and communication, and the sparse population of the forest districts, very little in the way of control has been attempted. A very comprehensive study of the fire problem has been outlined by Max Rothkugel. This covers a study of relative hazards in different forest types and regions, as well as of methods and organization of protection.

The law provides for regional nurseries to furnish planting stock in each of four main forest regions (Northern, Mesopotamian, Central,

and Southern), but lack of funds has prevented their establishment. It is also provided that when the forest map is completed, the Inspector General of National Forests shall, with approval of the Chief Executive, ask the Congress to expropriate lands of these classes: (1) forests which affect the stability of mountains or slopes; (2) those which prevent erosion of the beds of washes or torrents; (3) those which insure the existence of springs or of water courses in general; (4) those which fix coastal dunes or prevent coastal erosion.

In a message to Congress of September 30, 1915, President de la Plaza proposed a very comprehensive forest law, covering all the matters relating to the national forest policy and the administration of forests, which would provide an adequate "Régimen Forestal," with organized protection of the national forest resources and provision for their perpetuation. This law had not been acted upon at the time of writing.

The author concludes that Argentina, by virtue of the quantity, quality, and great variety of timber in her forests, can develop forest and wood-using industries sufficeint to satisfy completely the domestic demand for all products, as well as to play an important part in the reconstruction of Europe, but that these industries themselves are not yet capable of meeting the opportunity and are not likely to develop rapidly, if left to private initiative, which is inclined to hold back under present unsettled conditions.

W. N. S.

Die Vegetationsverhältnisse längs der Cordillera de los Andes S. von 41° S. Br.: Ein Beitrag zur Kenntniss der Vegetation in Chiloe, West-Patagonien, den Andinen, Patagonien und Feuerland. By Carl V. Skottsberg. Botanische Ergebnisse der Schwedischen Expedition nach Patagonien und dem Fuerlande 1907-1909. Stockholm, 1916. 1-366. Top. 23.

Skottsberg gives a comprehensive phytogeographical description of the vegetation of the Andes south of 41° latitude. All of the southern end of the continent below this latitude is divided into three regional formations. A text map accompanying the publication shows the limits of these. On the western slopes of the Andes extending to the sea and including the southern part of Tierra del Fuego is the temperate rain forest (Regenwälder). The deciduous forest (Sommerwälder) occupies a narrow belt in the eastern slopes. Lying east of this is the great Patagonia desert (Steppe). The first 160 pages is devoted mainly to a discussion of the different plant associations.

The giant of the rain forests is Alerce or Lahuen (*Fitzroya patagonica*). This species has a maximum height of 55 meters and diameters up to 5 meters. The trees that reach a height of 40 meters are Muermo or Ulmo (*Eucryphia condifolia*) and Coihue (*Nothofagus dombeyi*). Those that reach a height of between 20 and 30 meters are *Nothofagus nitida*, Huahuan (*Laurelia serrata*). Canelo or Foihue (*Drimys winteri*), Tique (*Aextoxicum punctatum*), Patagua (*Myrceugenia planiceps*), Luma (*Myrtus luma*), the two manius (*Podocarpus nubigena* and *Saxegothea conspicua*) and Cipres (*Libocedrus tetragona*).

On the east side of the mountains there are three distinct types—the *Librocedrus chilensis* forest, the *Nothofagus pumilo* forest and the *Nothofagus antarctica* forest. In both forest regions there is a full discussion of all the associations found in them.

The rest of the volume is devoted mainly to an enumeration of the plants of the region, in which some new species are described. In this enumeration full notes on the distribution of the species and the plant associations in which each one occurs are given. The publication is beautifully illustrated with 23 plates, most of which contain two or more views.

H. N. W.

New Jersey Department of Conservation and Development, Annual Report for 1919.

This report, rather belated, covers only eight months—the period between November 1, 1917, and June 30, 1918—owing to the change of the fiscal year for the State. Besides the general report of the board, written by the director, Mr. Gaskill, it contains reports of the State Geologist, the State Forester (the same person as the director) and the State Fire Warden. It does not record any notable accomplishment in forestry lines but repeats the attitude taken in the report of the previous year that New Jersey has *too much* forest: "We need fewer but better forests," and that "it is far wiser to leave most of our forests in private control and to make it worth while for the owner to care and develop them." This is good democratic doctrine but poor economic theory, and it would require some reasoning as to why it is "ultimately advisable" for the State to own 40,000 acres of forest, adding some 30,000 acres to the present acreage of State Forest. When it is stated that "New Jersey can well afford to clear three-quarters of a million acres of forest land" and "would then have remaining the

25 per cent of its area in forests which is commonly held to be necessary for the welfare of a State," by implication the director assumes propriety in this percentage. We had assumed that all professional foresters had discarded this attempt at a percentage figure which came into the world because accidentally Germany had about that percentage—overlooking that she was the second largest importer of forest products in the world. In another part of the report it is stated that "farmers, not farms, are needed" in New Jersey.

Although forest planting is declared unnecessary except in a limited way because "nature usually will perform the task at far less cost"; the Department therefore furnishes no young trees for forest planting, as is done in some States; assistance to woodlot owners by advice free of cost and demonstrations of forest improvement in the State forests is provided for.

Propaganda for the creation of a great forest park on the Kittatinny Mountains is supported by a map of the region within which the park is to be located.

The report of the Fire Warden points out the undesirability of reporting for the new fiscal year, splitting the fire season in two parts, and for matters of comparison proposes to wait for the end of the calendar year. While the effectiveness of the existing system of local wardens and fire fighters is attested, their work is limited to control of fires already burning, and hence the need for more lookout and patrol service is emphasized. "For the next quarter century, until the growing forest has recovered beyond the period of excessive younger stock, the State must carry this added burden as the price of past indifference and neglect."

B. E. F.

Philippine Mangrove Forest. By W. H. Brown and A. F. Fisher. Bureau of Forestry, Bul. 17, pp. 132, Plates XLVII. Manila, Philippine Islands, 1919.

In a portion of the area between high and low tide of many tropical countries there is developed peculiar vegetation composed of trees and other plants that form a distinct unit. This type, usually known as mangrove forests, is literally a forest of the sea. Because of their accessibility and for the reason that they produce many kinds of forest products, these forests per unit of surface are more valuable than any other forests in the tropics.

Brown and Fisher, of the Bureau of Forestry, Philippine Islands, have recently brought together in a beautifully illustrated bulletin val-

uable information concerning the character of the vegetation of these swamps and the products they contain. This is the third of a series of publications on the minor forest products of the Philippines. The forests are estimated to cover an area of between 400,000 and 500,000 hectares (about one million acres). A good description is given of the vegetation. This is followed by two keys to the genera of the plants in the swamps, one based on superficial and the other on floral characters. Pages 26 to 80 are devoted to popular description and notes of many kinds concerning the individual plants that make up the association. While the swamps are dominated mainly by the family Rhizophoraceæ they contain in all 30 species, representing 20 families.

Though chiefly useful for their minor forest products, virgin areas of the swamps contain heavy enough stands to be logged for lumber. The principal products are however firewood, tannin materials, and alcohol. The members of the Rhizophoraceæ family produce woods with very high calorific power and their barks yield a high percentage of tannin. The leaves of the Nipa palm, which is a constant element of the mangrove swamps, are a commercial source for thatching material, and the sap of its inflorescence is fermented for an alcoholic drink, and distilled for alcohol. Near Manila there are cultivated swamps in which Nipa and bakauan (*Rhizophora* spp.) are cultivated. An interesting account is given of the methods used in planting and cultivating bakauan. The bulletin is full of information concerning the commercial importance of this important type of forest.

H. N. W.

Philippine Bamboos. By W. H. Brown and A. F. Fisher. Bulletin 15, Bureau of Forestry, Philippine Islands, pp. 32, Plates XXXIII. Manila, 1918.

Brown and Fisher have brought together all the available information concerning the wild and native bamboos of the Philippines. In all nine genera including thirty species are described. Seventeen of these are erect and thirteen climbing. Following a key to the genera, popular descriptions are given of each species. A progress report is made of the plantations of the Bureau started in 1912. Of great value are accurate measurements made of a number of species during a period of 20 weeks of the growing period in which time a number of shoots attained a height of about 24 meters. The most rapid growth occurs nearer the end than the beginning of the growing period. Dur-

ing this time three of the shoots showed a weekly growth in excess of 3 meters; the fastest rate was 3.17 meters or an average of 45 centimeters a day for a week. The bulletin also contains definite data concerning the cost of planting, caring for and harvesting the crop.

H. N. W.

Report of the Chief of Bureau of Biological Survey for 1919.

This report is particularly interesting in the section on the campaign against predatory animals and injurious rodents. Not less than one and a half million dollars were available for this purpose, namely, \$592,000 of Federal funds and more than \$800,000 contributed by States, counties, farmers' and stock-growers' organizations, and individuals in co-operation. It is estimated that by this work a saving of live stock valued at \$5,000,000 and a saving of forage and crops valued at not less than \$14,000,000 was effected. Some 400 to 500 skilled hunters were employed in the war against stock killing animals and wild animals affected with rabies, over 30,000 having been killed and nearly \$200,000 recovered from the sale of skins. It is stated that about \$500,000 worth of stock was lost by being bitten by rabid animals, and approximately 1,500 persons are known to have been bitten, at least 47 of whom are known to have died from the consequences. The annual loss from rodents is estimated at \$300,000,000 and from house rats and mice nearly \$200,000,000. The extermination of prairie dogs has progressed on nearly 2,000,000 acres of private and 3,700,000 acres of public lands.

The new migratory-bird treaty act of July 3, 1918, and the supervision of national mammal and bird reservations come in for a lengthy discussion.

B. E. F.

The Arborescent Indigenous Legumes of Hawaii. By J. F. Rock. Bulletin 5, Division of Forestry, Territory of Hawaii, Board of Agriculture and Forestry, 1919, Honolulu.

The Hawaiian Genus Kokia, a Relative of the Cotton. By J. F. Rock. Botanical Bulletin 6, Division of Forestry, Territory of Hawaii, Board of Agriculture and Forestry, 1919, Honolulu.

Rock has published two papers on the arborescent flora of Hawaii. In one, the arborescent indigenous legumes of Hawaii is considered and is of special interest to foresters because it contains interesting notes concerning the well-known Koa tree, the wood of which has been exported under the name of mahogany. Rock describes two varieties

of Koa (*Acacia Koa* Gray). These he names *Acacia Koa lanaiensis* and *Acacia Koa hawaiiensis*. The second paper treats of the genus *Kokia*. This genus is of interest because it treats of the very rare members of this genus of which one species has already become extinct. Both publications are beautifully illustrated.

H. N. W.

Philippine Forest Products as Sources of Paper Pulp. By W. H. Brown and A. F. Fisher. Bulletin 16, Bureau of Forestry, Philippine Islands, pp. 13. Manila, 1918.

By the same authors is also a bulletin on the wild sources of paper pulp for the Philippines. Most of this article is devoted to the possibility of using native bamboos and grasses for paper. A number of tables are published showing the length and diameter of the fibers of species of bamboo, banana, hemp, grasses, rice straw, palm, and the woods of three forest trees.

H. N. W.

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Production of Goats on Far Western Ranges. By W. R. Chapline. Bulletin 749, U. S. Department of Agriculture. Contribution from the Forest Service. Washington, D. C. 1919. Pp. 35.

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The contents include the following articles: Brushwork and Milling in Maoriland, by J. T. Worsley; The Need of a State Forest Policy for Washington, by J. K. Pearce; The Land Clearing Problem, by E. T. Clark; Logging with the Motor Truck, by B. H. Crowder; Study of Quantity of Sawmill and Woods Waste in Western Washington Lumber Industry, by B. P. Kirkland.

PERIODICAL LITERATURE

SILVICULTURE, PROTECTION, AND EXTENSION

Hunting in the State Forests of the German States Management of the game resources of the State forests is of considerable importance at this time, from the financial, silvicultural, and administrative viewpoints. Objects should be to insure greatest lasting returns to the State treasury, the protection of the silvicultural in-

terests of the forest, and the prevention of injury to the general hunting business, especially in communal forests near State lands.

In Prussia, with a few exceptions, the hunting is managed by the Oberforster, according to a shooting schedule drawn up yearly with the approval of the higher authorities. The Oberforster may designate other forest officers to shoot for him, but outsiders may not do so except in the presence of himself or other forest officers. Methods of hunting are prescribed. The Oberforster disposes of all game killed, and from the proceeds pays his subordinates a fee for the shooting, receives an allowance himself for expenses of keeping dogs, hiring beaters, and transporting game, and pays the balance to the treasury. The State may pay for feeding game in severe winters, for fencing, or to replace damages to game by unusual causes. Forest officers may kill smaller animals such as fox, marten, and waterfowl, under certain restrictions, without accounting for them to the treasury. In the few cases where hunting rights are leased to private individuals, the lessee may hunt himself or employ a trained hunter; guests may hunt only when the lessee or his hunter are present. The methods to be used are prescribed in some detail. Leases are not transferable, and the lessee is responsible for all damages done by himself, his hunters, or his guests, and also for all damages done by the game to the forest. Forest officers may hunt small game even on leased areas. Net income from the hunt was 800,000 marks in 1917 and 1,000,000 in 1918, or from 0.27 to 0.33 marks per hectare per annum. In Bavaria the State administers the hunting on slightly more than half of the State forests, the rest are leased to private individuals or to the forest personnel. Where managed by the State, all receipts go to the treasury, and all

costs are paid by it, including a shooting fee to forest officers. Leased forests are let to the highest bidder, or at private sale in case of small tracts used in conjunction with adjacent communal or private forests. Forest officers may take part in the bidding. Leases run six years. Lessees may issue written hunting permits, recorded with the forest officer, to their guests. Lessees may arrange with the local forest guards to manage their hunting. Leases may not be transferred or sublet to third parties. The forest authorities may require a lessee to restrict his shooting so as not to endanger the game supply, or to shoot more in order that an overstocking of game may not endanger the forest. The lessee has to look out for game protection himself. In 1917, net revenue per hectare was for State administered districts 0.37 marks, for those leased to forest officers, 0.22, and for those leased to private individuals (usually the more desirable areas), 1.29 marks. With State management and with leases to forest officers the authorities have better control over the amount of game, and can supply meat at low prices to forest laborers.

In Saxony, the forest supervisors (*Reviervorwalter*) manage the hunt for the State treasury, and get 40 per cent of the net proceeds. Each *Revier* forms a "game working circle," divided into several hunting districts coincident with ranger districts. The amount of game to be killed is determined each year in advance. Supervisors buy fodder and salt for the game; keep dogs and other hunting animals such as ferrets, owls, etc.; provide weapons, ammunition, and other contrivances; maintain shooting stands, screens, shades, and the like; entertain hunting guests; for all of these they receive an allowance from the treasury. Subordinate officers are paid a fee for shooting and for skinning and dressing game killed by themselves or by outsiders in their districts. The supervisor disposes of the more important kinds of game for the benefit of the treasury at fixed prices (forest officers may buy a moderate amount for their own use at fixed low rates), while he gets free certain small game killed by himself or his subordinates, and they get the small predatory, fur-bearing animals which they kill. The average net receipts per hectare from the 146,000 hectares of State forest were (1908-1917) 0.26 marks, and for 1917 were 0.32 marks.

On two-thirds of the 197,000 hectares of Württemberg State forests the hunting is managed by forest officers; the other third is leased. Under State management, the *Oberforster* on each forest submits a shooting plan and financial budget at the beginning of each year. He

gets a definite sum for his trouble, based on the net income from the hunt, and also gets shooting fees, fixed for each kind of game, and allowances for hiring assistants. He also gets the horns and occasional small game not specified as belonging to the State. He is not allowed to lease outside hunting for his own account if he is responsible for managing the hunting on the State forests under his charge. Game killed is sold at fixed rates, and the proceeds turned in to the treasury. Leases run for six years, terminable for cause at any time, and may not be transferred or sublet, except by special permission. The lessee may designate a partner or a representative to hunt independently, and either of these may invite qualified guests to hunt while they are present. The lessee is responsible for any damages or violations of regulations by himself or his representatives or guests, must observe certain rules for protection of beneficial birds, must allow a certain closed season for all game, and must not interfere with field or forest culture. The leased hunting brought a net return per hectare in 1917 of 0.91 marks, while that on State administered districts netted 1.03 marks, in spite of being less desirable game districts.

In Baden, forest officers carry out the hunting on about one-third of the 85,000 hectares of State forest. The kill is made in accordance with an annual plan, and all game, except certain migratory birds, is sold to dealers at fixed prices, for the benefit of the treasury. Forest officers may buy game for their own use at a fixed price. They are allowed a certain sum for keeping hunting dogs, and a shooting fee fixed for each kind of game to cover their trouble and the expense of providing weapons and equipment. On leased forests, there may be not more than three lessees for any one district, nor may they allow outsiders to hunt except with the approval of the forester. In case of damage to the forest by game, the lessee must pay not only the loss but an added amount to cover costs of culture and loss of increment. No claim is made for damages to the forest less than 10 marks or to fields less than 2 marks.

In Hesse, all the hunting is leased to the highest bidders for 12-year periods. A unit is from 400 to 600 hectares. The lessee must observe certain regulations as to methods of hunting, may allow guests to hunt only in his company (except members of his immediate household), and is responsible for all damages caused to the forest or to adjacent property by the game or by hunters. The Oberforster may require him to keep the number of rabbits and similar harmful animals reduced to a safe point, or may authorize the foresters to kill it off. With

consent of the forest administration, the lessee can hire the forest officer in charge of the district to manage the hunting for him. Due to exceptionally favorable conditions, the net income from game leases on the forests of Hesse averages 1.76 marks per hectare per annum.

In Mecklenburg-Schwerin, hunting in State forests is with a few exceptions carried on by the forest personnel. Where they have no time for it, or where game protection is difficult, hunting may be leased. All game killed is sold at a fixed price, for the benefit of the treasury.

Except for small areas reserved for the Duke or leased to private persons, the hunt on the greater part of the 83,000 hectares of Brunswick State forests is managed by the forest authorities. Here forest officers pay a fixed tariff for all game killed, and sell it for their own account. The treasury gets a share of the surplus, varying from nothing for the first 100 marks to 90 per cent of the ninth and every succeeding 100 marks. In 1917-18 the average income for each forester was only 323 marks. The net revenue received by the State was 0.53 mark per hectare. The forest guards pay for costs of driving, feeding game, damages done by game, costs of fencing, and to cover it receive fees for game killed and also the income from rabbits and other small animals they may kill. The number of deer to be killed each year is fixed in advance, but there is no special restriction as to the kill of small game. Leased tracts are let to the highest bidders, who may not sublet except with special permission, nor may they issue hunting permits for money. They feed the game in winter at their own expense, and are required to keep surplus game killed off as the forest officer may direct. There are certain restrictions as to killing does or fawns. Lessees are not responsible for damage done by game to the forests, nor on the other hand can they claim damages for changes in the methods of management of the leased areas or even for partial fencing against game. The numbers and kinds of game killed must be reported each year.

In general, it is concluded that leasing is not desirable, since, although the immediate returns may be greater, there will be a tendency either to deplete the stock of game animals or to let it increase too much, to the detriment of the forest. There is also a tendency either toward friction between lessees and forest officers, or toward too close co-operation, both detrimental to the interests of the forest and bad for the morale of the force. State forests should serve as game reservoirs

to maintain the supply in nearby communal and private forests. Leasing is apt to prevent this, and will also reduce the communal revenues from hunting leases by offering districts in competition with their forests. State management is best for all interests, and should be carried on, under the supervision of the forest supervisor, by himself and subordinates, according to an annual plan approved by his superiors. He should be allowed an addition to his salary to cover expense of keeping dogs and providing equipment, and all receipts should go to the treasury and all costs be paid from it. The guards should be paid a fee for every piece of game killed, and should get free the horns, entrails and fat, for dressing the game. They should also be allowed to buy game for their own use at prices paid by the dealers.

W. N. S.

Die Jagd in den Staatsforsten der grösseren deutschen Bundesstaaten. Eberts. Forstwiss. Centralbl. 41:41-49; 91-101; 132-148. 1919.

*Coppice in
Southern
France*

The lack of labor and means of transportation resulting from the war have delayed the regular cuttings in the evergreen oak coppice stands of southern France by two, three, and even four years. This delay may be a blessing in disguise since it affords an opportunity to lengthen the rotation with the object of producing larger sized material, which in the last 15 or 20 years has become increasingly valuable. Assuming that the Vesulian law (that the volume production varies as the square of the age) holds for trees between 20 and 30 years old, calculations indicate that the net revenue will be three or four times as great at 25 as at 20 years of age. The longer rotation is also preferable from a silvicultural point of view since the short rotations commonly in use have impoverished both soil and stands.

S. T. D.

Les taillis du midi et la guerre. De Brun, H. Revue des Eaux et Forêts, 57:147-150. 1919.

*Snowbreak
and
Top Rot*

Although snowbreak is not as common in Sweden as in Central Europe, it occurs from time to time over considerable areas doing much damage in the spruce forests of Norrland. Two such devastations took place within the last decade, namely, in 1910-11 and 1915-16, in regions where utilization is unprofitable and all trees which only lost their tops had to be left standing. The question then arose how rapidly these trees deteriorate. This question was investigated by Torsten Lagerberg of the Swedish Ex-

periment Station. He found that top rot occasioned by various Polyporus species are a constant sequel of the snowbreak; that in the first years the disease develops conspicuously rapidly; that the further development depends upon the vigor of the tree, proceeding more rapidly in the faster growing than in the slower growing specimens; those broken at a diameter of 10 cm. or more showing more rapid progress of the disease; that woundwood formation and a resin cover retard the rot, and can in some cases prevent it altogether. Altogether the loss in stands of better quality is greatest, and in all cases earliest possible utilization is indicated.

Snöbrott och Toppröta Hos Granen. Meddelanden från Statens Skogstorsöksanstalt Haft. 16. Nr 5, p. 115-165.

*The Óidium
and the Oaks
of Western
France*

The fears which were expressed by M. Doé in the Rev. Eaux et Forêts for March, 1919, as a result of his experience in Champagne, that the óidium may prove fatal to the oak in France, are not substantiated by the history of the fungus in the western part of the country. Here, in spite of

the fact that the disease has been present and at times virulent since 1907, no serious damage has been done and no particular difficulty has been experienced in converting coppice stands into high forest. The explanation of the markedly different reaction of the oak to the óidium in the two regions appears to be that in Normandy and Brittany the oak is in the zone of optimum growth, while in the more continental climate of Champagne its physiological resistance is less. Even in western France, however, individual trees suffer seriously from the disease when their vitality has been weakened by frequent pollarding or other mistreatment.

S. T. D.

L'óidium, et les chênes de l'Ouest de la France. L. G. Aubert. Revue des Eaux et Forêts, 57:189-195, 1919.

UTILIZATION, MARKET, AND TECHNOLOGY

*British Care
With Russian
Hardwood Timber*

Prior to the war and the Russian revolution, England imported annually enormous quantities of timber from Russia, both coniferous and hardwood, and British capital was very heavily interested in sawmills in Russia. Russian oak was a prime favorite with British cabinet makers. The Russian oak and also other more valuable species, were brought to England in the whole

log, or in the half log. The British timber merchant upon receipt of the logs would saw them in his own mill, carefully keeping all boards together from one log. The Russian oak, being beautifully grained, was in great demand by furniture manufacturers for making entire suites from one log, and by keeping all the boards from one log together, it was possible to match closely the grain and to have the suite uniform. The log is reassembled after sawing, the boards placed in their former relative positions in the log, and when placed in the yard for seasoning have thin strips of wood between each board, and an iron band nailed over the edge of each board (on end of log) to prevent any possible shifting of boards. This care is rewarded by a fancy price received from cabinet makers.

J. D. G.

Care of Russian Oak by British Timber Dealers. American Lumberman, November 22, 1919, p. 66.

The forests of Alsace-Lorraine cover 443,451 hectares, of which 138,869 hectares belong to the State. The total annual cut of wood is about 2,000,000 cubic meters. Under the former French control the forests were managed mostly on the selection system, transportation was not developed, and timber was sold on the stump, so that there was a tendency toward monopoly of each unit and lower prices for stumpage than the market justified. The Germans changed this by selling the logs, with the result that there were more bidders and better prices, and numerous local wood-using industries sprang up near the forests. Roads were developed. A high-forest system, with reproduction cuttings, was substituted for the selection system except in the higher Vosges. Spruce and pine, and recently larch and Douglas fir have been introduced in the predominant silver fir stands. Two hundred and fifty thousand hectares, three-fourths of it in Alsace, are managed as high forest; 150,000 hectares as coppice-with-standards, and small areas as coppice, tanbark forest, etc. Of the high forest, one-third is silver fir, nearly one-third beech, one-sixth pine, and one-eighth oak. Fir predominates in the Vosges, while pine is in the valleys and foothills; beech is most abundant in the foothills, and oak often predominates in the lowlands. The forests of the Lotharingian plateau are almost exclusively hardwoods. The fir grows rapidly, yielding five cubic meters per hectare per year, and can yield seven cubic meters if thinned properly. The wood is used for local needs and the surplus

*Forestry
and the Wood
Industry in
Alsace-Lorraine*

goes down the Rhine. Because of the knotty material produced under the former selection management, it is inferior to the fir from the Black Forest, so unable to compete with it. Beech, formerly chiefly valuable for firewood, has lately found a ready market for railroad ties, while the thinnings bring good prices for fuel. Pine is used chiefly for mine timbers. Oak, formerly managed as coppice-with-standards, is now almost all high forest, and is left standing through two rotations of beech. When the underwood is cut out, the oak standards are trimmed to a height of at least six meters, in order to produce clear lumber. Under the German regime, one-fourth of the possible cut each year was reserved to be cut only in emergencies, so that there is now a large surplus of mature timber, especially in the fir districts. There was a considerable export of sawed lumber to France until it was stopped by high import duties in 1895, since when most of the French trade was in unmanufactured wood, chiefly pulp. The demand for long timbers and large sizes, from Belgium, Holland, and Luxemburg, made up for the loss of the French trade.

W. N. S.

Die Entwicklung der Forstwirtschaft und des Holzhandels in Elsass-Lothringen. Kruhoffer. Forstwiss. Centralbl., 41:57-65, 101-109. 1919.

FOREST GEOGRAPHY AND DESCRIPTION

New and hitherto little known sources of
Forest Resources timber supply for the Allied countries are being
of the made known nowadays. The Caucasus comes
Caucasus forward with an estimated available supply of
 forests which are said to cover 18,000,000 acres.

of which some seven and one-half million acres belong to the State, the remainder privately owned. The following data are given by Mr. Baievsky as the average annual production, cost and profit:

Total amount produced, cubic sazhen (1 sazhen equal to 343 cubic feet)	141,766
Gross receipts, roubles (1 rouble equal .51 cents, <i>normally</i> ; however, the rouble is now worth about .05 cents)	1,126,864
General expenses, roubles	678,644
Net profit, roubles	448,220

It is said that the Caucasus forests are of great variety and they must be of very unusual quality if the diameter measurements quoted below are accurate. Little exploitation has taken place to date. The important species are pine, spruce, oak, beech, hornbeam, birch, maple,

poplar, basswood, alder, and elm. The following estimated percentages of species are given:

	Percentage
Caucasian beech	25.8
Oak (3 species).....	16
Hornbeam	13.1
Pine (6 species).....	8.3
Spruce	6.7
Fir	6.1
Other species	24

The report gives the following interesting age, height, and volume data:

Species	Age, years	Height, feet	D.B.H. feet	Volume, cubic feet per acre
Caucasian beech	200	140	7	8,000
Oak	120	100	2	5,000
Pine	100	120	4	8,000
Spruce	250	180	5	12,000
Fir	250	170	7	16,000

Spruce 5 feet at d.b.h. and fir with a 7-foot d.b.h. are interesting, but one is inclined to be a bit skeptical of such diameters, even in Russia, where almost anything might happen nowadays. The species of conifers are given, as follows: Pines (*Pinus sylvestris*, *montana*, *laricio*, *maritima*, *pinca*, *eldarica*), Spruce (*Picea orientalis*), Silver fir (*Abies nordmanniana*), and several species of *Juniperus*. The spruce is said to have proven very satisfactory in piano manufacture in Petrograd and Austria.

J. D. G.

The Caucasus—Its Resources and Trade. By Boris M. Baievsky. Russian Division, Bureau of Foreign and Domestic Commerce, U. S. Dept. of Commerce. Supplement to Commerce Reports.

According to the Polish Consulate General in London, the new Polish government is starting in on a campaign of interesting other European nations, especially Great Britain, in its forest resources. Poland's financial condition is deemed so critical that she has decided to put her forest resources, which are said to be enormous, on the market. The first installment of the timberlands which Poland proposes to offer for exploitation is said to contain more than 15,000,000 cubic meters. The plan seems to have been adopted of exploitation by the Polish government itself, which

Timber
Resources of
Poland

move is expected to lead large private timber owners to follow suit. It is thought that this decision may mean an opportunity for American manufacturers of logging and sawmill machinery. Sweden, being a closer neighbor of Poland, will probably not overlook this opportunity. Most of the sawmill machinery in the Archangel region of North Russia is of Swedish make, even in mills owned by British capital.

J. D. G.

Poland to Develop Its Timber Resources. American Lumberman. November 22, 1919, p. 66.

MISCELLANEOUS

<i>French</i>	A note appears in the November number of
<i>Foresters</i>	<i>Revue des Eaux et Forêts</i> to the effect that a
<i>to North</i>	mission of French foresters is to be sent to study
<i>Russia</i>	the forests of the Kola Peninsula, in Russian
	Lapland, with especial reference to securing in-
	formation relative to the desirability of estab-

lishing paper and pulp mills in that region. A Norwegian logging engineer, familiar with river driving and rafting and hydro-electrical installations, will be a member of the mission. The foresters are to study especially the density of the stands, quality of timber, and the characteristics of the principal species (*Pinus sylvestris* and *Picea excelsa*), and the conditions of exploitation and transportation of the timber to the plants. From personal observations of the writer near Kola Bay, in April, 1919, there is no question of the extent or quality of the timber along the Murman Railroad, though the timber is scattered and rather stunted for a distance of some 30 miles south of the town of Murmansk. Kola Bay, moreover, is a wonderful harbor, the only port open all the year round on Russia's northern seacoast, and it is predicted that some day Murmansk will be one of the important ports of Europe. The inlet at the new town of Murmansk (built in 1916-17, upon the completion of the Murmansk-Zvanka Railroad) is 1½ miles in width, the harbor being 32 feet deep at the docks and 70 feet deep in the middle. The Russian government laid out the town of Murmansk along broad lines with the plan of extensive development to follow in dock and railroad facilities, all of which was, of course, stopped by the revolution of 1917.

J. D. G.

Avis. *Revue des Eaux et Forêts.* November, 1919, p. 259.

NOTES

The following resolutions were adopted by the Second Southern Forestry Congress at New Orleans, January 28-30, 1920:

FOREST DENUDATION

Whereas the supplies of softwood and hardwood timber in the Southern States are rapidly diminishing, with a consequent influence upon the price of lumber and other forest products, and

Whereas the customary practice in lumbering and turpentineing results in the denudation of the forest and the leaving of large areas unproductive and idle for indefinite periods; therefore

Be it resolved by the Southern Forestry Congress that it deplors the continuance of such practice of denudation and urges, in order that such practice may be avoided, the enactment of legislation by the Southern States that will require or make possible the adoption of measures by owners that will prevent such denudation and will afford an opportunity for a natural replacement of forest growth on lands not suited or not now needed for agriculture or settlement; and, furthermore, the Southern Forestry Congress urges the States and the Federal Government jointly to cooperate liberally with owners in this direction.

SEED TREES

Whereas the South is approaching the end of its virgin timber supplies, and

Whereas great necessity exists for retaining on cut over lands enough seed bearing trees to restock these lands; therefore

Be it resolved that the Southern Forestry Congress urges all owners of forest lands in the South to pay particular attention to this matter which is of such vital concern to the South's welfare.

TAXATION

Whereas the present system of annual taxation on growing forests encourages or compels early cutting, and

Whereas special consideration in matters of taxation is often necessary in order to encourage the investment of private capital in timber growing; therefore

Be it resolved by the Southern Forestry Congress that it approves and recommends passage by State legislatures of special tax legislation relating to forests, based on the separation of land and timber values, and the deferment of taxes on the timber until harvested; also laws giving special tax relief on properties devoted to timber growing; provided means be devised for reimbursing the counties for any lack of revenue incurred by such deferment or relief.

STATE FORESTRY DEPARTMENTS

Whereas the forestry problems of the South are of momentous importance, and

Whereas the science of forestry involves in its practice long periods of time, and necessitates continuity of work, therefore

Be it resolved that the Southern Forestry Congress urges upon the Southern States to immediately organize strong, non-political forestry departments and to make adequate appropriations for their effective maintenance.

FORESTRY DEPARTMENT FOR MISSISSIPPI

Whereas the supplies of timber in the South are rapidly diminishing, and

Whereas there are large areas in the South lying unproductive and idle as a result of the denudation of the forest, and

Whereas it is essential to the welfare of each Southern State that such denudation be prevented; therefore

Be it resolved by the Southern Forestry Congress that it urges the legislature of Mississippi now in session to enact the bill recently introduced which provides for the establishment of a State Board of Forestry, and the appointment of a State Forester.

STATE FORESTS

Whereas the Federal Government recognizes the economic importance of forests in the preservation of stream flow, and the production of timber, and has in consequence set aside portions of the public domain and acquired other areas through purchase as National Forests, and

Whereas public forests are of equal importance to the several States; therefore

Be it resolved that it is the sense of the Southern Forestry Congress that the Southern States should purchase and maintain State Forests for these reasons; and also, to serve as demonstrations in practical forestry.

SCIENTIFIC RESEARCH

Whereas the Southern Forestry Congress recognizes the importance of scientific research and the value of close cooperation in work of such fundamental character; therefore

Be it resolved that the projects of the National Research Council in regard to forestry be endorsed and the support of the Southern Forestry Congress be pledged to the undertaking.

WEEKS LAW PURCHASES

Whereas the Southern Forestry Congress is heartily in accord with the principle of increased public ownership of forest lands which are chiefly valuable for timber production and the protection of streams; therefore

Be it resolved that we do hereby urge the Federal Congress to enact the measure now before it for continuing the purchase of forest lands under the Weeks law appropriating two million dollars a year for the next five years.

FEDERAL COOPERATION IN FIRE PROTECTION

Whereas the problem of forest fires is the most serious one in connection with the regeneration of our southern forests,

Be it resolved that the Southern Forestry Congress urges the Federal Congress to increase the cooperative fire protection appropriation to \$200,000 for the purpose of cooperating with the States in fire protection under the Weeks law, which appropriation is contained in the bill appropriating funds for the Department of Agriculture for the Federal fiscal year 1921.

FEDERAL FOREST EXPERIMENT STATIONS

Whereas there is a great need for demonstration areas in the Southern pineries and the Southern Appalachians, upon which methods of forestry practice may be tried out; therefore

Be it resolved that the Southern Forestry Congress urges the establishment by the Federal Government of a forest experiment station in each of these regions, with adequate appropriations by the Federal Congress for their maintenance.

REORGANIZATION OF THE OFFICE OF FOREST INVESTIGATIONS OF THE
U. S. FOREST SERVICE

The work of forest investigations of the U. S. Forest Service covers the whole field of forest conditions in the United States. The general scheme of organization for the Service has required that the large National Forest areas in the West should be organized and administered as units with considerable latitude of action. Heretofore the forest investigations carried on in connection with the western National Forests have been subject to direct supervision through the district offices with indirect technical control by the central office in Washington. The investigative men in the districts have been working under conditions of isolation and have often felt the lack of the increased facilities and sympathy with their problems which would result from closer and more frequent contact with other men engaged in similar lines of work. In order to remedy at least partially this situation, the men engaged in fundamental studies, including those stationed in the West, have been transferred to the direct supervision of the Office of Forest Investigations in Washington. The plan is that they will have comparatively frequent details to Washington and possibly also in special lines of work to various other regions.

Another phase of the reorganization has to do with the application of the results of investigations in the practical solution of the administrative needs of the Service. The men on fundamental studies have been relieved of the direct responsibility for applying their results. On the other hand, in order to more effectively secure the prompt application of valuable findings, an investigative officer has been assigned or designated in each district office who will be definitely responsible for the application of the results of forest investigations to administrative practice. He is expected to be thoroughly familiar with all the research work that is being done on district problems and to determine and demonstrate to the various administrative officers, the application and value of these results. At the same time he is expected to carry on investigations of a less intensive character to secure for immediate use tentative answers to some of the pressing administrative questions.

While the new scheme is admittedly in the nature of an experiment, the Forest Service feels that it is a distinct step in advance for the benefit both of the men engaged in fundamental studies and for those on administrative work who need reliable solutions to their problems.

The advantages to the men should logically reflect in their work and in general increased effectiveness of the Forest Service administration.

J. K.

Airplanes and hydro or sea planes have been on trial during the last season for forestry work, fire control, and mapping. The *Canadian Forestry Journal*, in various contributions, records some of these experiments, and a more detailed account of the work in Quebec will be found in the January number of the JOURNAL. It appears that in the northern woods with its numerous lakes the seaplane has unquestionably proved its value, while in the waterless areas on the Pacific slope, where landing places must be prepared, a successful patrol service of airplanes is recorded. Here the Air Service of the War Department in co-operation with the Forest Service for three months maintained uninterrupted service, 745 flights, covering 92,605 miles, having been made in California over five National Forest areas. At first six patrol routes were followed twice each day by six Curtis airplanes, covering about 9 million acres of heavily timbered country on an average round trip of 320 miles. With the fire season becoming critical more rapid DeHaviland planes of greater climbing power were substituted, two new bases were established, and new routes laid out extending over fifteen National Forests; 8 airplanes covering twice each day over 20 million acres. Eight additional airplanes were used on alternate days to allow for necessary repairs and relief of pilots, of whom there were sixteen besides twenty-two mechanics. Only six forced landings with one fatality and no injury to pilots or observers had to be made during the season. At an altitude of 5,000 feet fires at least 30 miles distant could be detected, and in one case a 200-acre fire 35 miles away was located within half a mile. The reporting of fires was not as satisfactory as the discovery and location, parachutes with messages and carrier pigeons being tried. Without wireless telephone or some other method of hastening the reports, it is stated, the airplanes can never function as efficiently as the present lookout system. Reports of the progress of fires, however, could be secured more completely and satisfactorily by airplane. Nothing is said about the cost. Further experiments are promised.

The National Lumber Manufacturers' Association contributes to the discussion of a national forest policy by printing an address of its

Secretary-Manager, Mr. Wilson Compton, before the Tri-State Forestry Conference at Indianapolis, under the caption "Economic Aspects of State Forests." The address attempts to answer four questions, namely, "How much standing timber will probably be needed?" "What species of timber should be reforested?" "Where should the forests be located?" "Who should grow and own the forests?" This last question is, of course, the most important one, and the answer indicates the attitude of the lumbermen. "Effort, misguided though it is, to compel through legislation reforestation of private logged-off lands would by no means solve the problem, even were such law enacted. Trees can not be legislated into existence. Neither do laws change men's minds as to what is profitable and what is not. Such legislation would secure, not a replacement of the forests through private enterprise but, instead, the widespread reversion to the State of the privately owned cut-over lands." "A 'forest policy' that does not produce forests is not a forest policy." The argument is for State forests: "The public should pay for public benefits."

SOUTHERN PINE ASSOCIATION CONTRIBUTES TO FOREST RESEARCH

The National Research Council has received a gift from the Southern Pine Association of \$10,000 to pay for the incidental expenses of a coordinated scientific study by a number of investigators of the regrowth of trees on cut-over forest lands with the aim of determining the best forestry methods for obtaining the highest productivity. Although some of these cut-over lands can perhaps be most advantageously used for agricultural purposes there is a large acreage of them which will yield better returns if devoted to re-forestation.

Despite the large amount of forest study that is being conducted under Government and State auspices, there is much need for additional investigation. This is well recognized by lumber men and is especially indicated by the action of the recent meeting of the Southern Forestry Congress at New Orleans in formally endorsing the scientific projects of the National Research Council in regard to forestry. The gift from the Southern Pine Association is made as a result of this action. The investigation will be conducted under the advice of the Research Council's special committee on forestry and will not duplicate any present government or other undertakings along similar lines.

With the November number the *American Forestry* magazine publishes besides its regular issue a "Foresters' Edition," in which tech-

nical and semi-technical material is substituted for some of the more popular articles on birds, shade trees, memorial trees, etc. Members can have either one or the other edition. The object, of course, is to interest readers in the technicalities of the subject. The November number contains the following material of this character: An account of the forest plantation on Pikes Peak; a short statement regarding the Federal income tax on forest industries; an account of the forestry practice of the Homestake Mining Co. in South Dakota; a controversial discussion of Compton's fourteen points, and several other brief statements regarding a national forest policy; an account of forest restoration in Belgium; extension work in forestry; a description of timber cruising in British Columbia.

Mr. Jorge Pinzon, formerly of Yale Forest School, has returned to his native country of Colombia, South America. He is connected with the firm of Patterson, Gottfried & Hunter at Bogota, and is studying the possibility of exporting on a large scale some of the valuable forest resources of Colombia. Mr. Pinzon reports that the Colombian Fiscal Code of 1912 was modified in 1919. A Forest Commission has been authorized to send three students to study forestry movement in Colombia and to supervise the execution of the regulations to be formulated by the Ministry of Agriculture, and the Government has been decreed having ample power to guide the forestry abroad. Mr. Pinzon was able to assist the Minister of Agriculture in the formulation of the Forest Regulations, and is still serving in an advisory capacity.

The Conservation Commissioner of the State of New York, G. D. Pratt, attempts a novel way of attracting attention of the legislature to his needs, namely, by an open letter to the Governor and members of the legislature during the recess of the latter so that they may have time to ruminate upon them. The most important of his propositions is a division of the State into ten forestry districts, each to be placed under the supervision of an experienced forester, whose business it would be to advance forestry and forest policies in his district in every way, in forest protection, forest survey, assistance in private reforestation, scientific cutting, marketing forest products, etc. There is also provided distribution of plant material free of charge, and revision of taxation.

Among minor forest products appear juniper oil, cedar oil, and hemlock oil, for the extraction of which the Quinte Chemical Co., with a capital stock of \$40,000, was lately established in Desoronto, Canada.

To impress the wastefulness of cutting small-diameter trees the New York Conservation Commission publishes a diagram comparing the number of trees of various sizes required to make 1,000 feet of lumber. The numbers run 50 for 6-inch trees; 21 for 8-inch; 13 for 10-inch; 8 for 12-inch; 6 for 14-inch; 4 for 16-inch, and 3 for 18-inch trees.

The Dominion Forestry Branch of Canada has continued its work at the Forestry Experiment Station at Petawawa, Ontario, by laying out a number of permanent sample plots for the study of growth, yield, stem form, and habits of certain species under various conditions, combined with experiments with different silvicultural methods of planting, thinning, cutting, etc. The investigations are carried on under the supervision of Mr. Claughton-Wallin.

The Forest Preserve Commission of Cook County, alias Chicago, is ambitious to rival Boston with its forest parks. For the present the forest preserve comprises nearly 15,000 acres in 16 separate tracts and the plan is to double this acreage. So far around \$3,000,000 have been expended. The preserve is divided into eight districts, each with a "district forester" in charge.

A timber raft on novel lines, 360 feet long, 42 feet beam, 18 feet deep, containing 1,242 standards of sawed timber of various dimensions, built by a Canadian in Norway, was this summer successfully towed through a storm across the North Sea to England.

On October 6 the offices of the American Forestry Association in Washington were burned out, entailing a loss, especially of back issues of the magazine. A call for assistance in replacing back issues of *American Forestry* is printed in the November number.

Within the past two or three years fourteen Canadian pulp and paper companies have engaged professional foresters.

SOCIETY AFFAIRS

REPORT OF THE SECRETARY FOR 1919

A considerable increase in membership has occurred during the year 1919. With the close of the year the records show 354 Senior members, 27 Members, 61 Associate members, 12 Honorary members, and 6 Fellows.

Notification of election was sent just before the close of the year to a number who have not yet had time to indicate their acceptance. It is reasonable to expect such acceptance and so the membership will, in all probability, before long be increased by the addition of 12 Senior members, 3 Associate members, and 13 Members.

Final action is also being taken by the Executive Council on a large list of nominations on which the Senior members and Fellows have already had the opportunity to express themselves. A further list for nominations is in preparation for circulation and subsequent final action by the Executive Council.

Ten sections of the Society have now been authorized and organized. The latest section to be formed is the one at Madison, Wisconsin. During the past year the ten sections held 21 business meetings and 43 open meetings. Activity of the members of the Society in their respective regions through the sections means much to the life of the whole Society and it is hoped that there will be every effort made to keep the sections active.

Applications for the formation of a section in the Northeast and another in the Southeast have been submitted to the Council for approval. The proposed formation of these two new sections is of importance to the Society because they will provide means for organized effort in two important regions. Organized effort is particularly essential in view of the opportunities before the foresters of the country in the new national forest program.

The Committee on Nominations and in charge of the election of officers and one member of the Executive Council for the five-year term beginning January, 1920, certify the result of the election as follows: President, R. C. Bryant; Vice-President, C. G. Bates; Secretary, Paul D. Kelleter; Treasurer, A. F. Hawes, and Member of Executive Council, Burt P. Kirkland.

PAUL D. KELLETER,
Secretary.

REPORT OF THE TREASURER FOR 1919

The report for the present year shows, as might be expected, that the Society is experiencing an increased cost of living. The full effect of this tendency is not shown by the figures, since it is only with the printing of the last two issues of the JOURNAL that the printer's bill has increased 30 per cent. Expenses for plates and line cuts, for proof-reading, envelopes and mailing, and stationery have likewise gone up.

It will be noticed that the figure given for the publication and distribution of the JOURNAL (\$3,172.16) includes \$337.45 for the printing of the last issue of the preceding volume. It does not, however, include the last two issues of the present year. The cost of these is given under liabilities at \$1,194.47.

The average cost of printing and distribution of the seven issues of the JOURNAL covered in the present report was \$453.16 for each issue. This is an average cost per copy of 38 cents as compared with 32 cents for last year.

The receipts from advertising and from the sale of back numbers of the magazine have increased slightly, but not in proportion to the expenditures. The excess of assets over liabilities is \$643.21, as compared with \$1,017.32 at the beginning of the year.

Evidently measures must be taken to increase the revenue of the Society in order to meet its increased expenditures. This can be done by increasing the sale price of individual numbers of the JOURNAL from 50 cents to 75 cents apiece; and the subscription price to non-members from \$3 to \$4 a year. Previous subscribers should not receive the magazine until they have renewed their subscriptions, as the Society has lost about \$100 worth of magazines annually by sending out the first three issues before removing the stencils of persons who have not paid up.

An estimate of receipts during 1920 at the present rates is as follows:

Annual dues, 350 at \$5.....	\$1,750.00
Annual dues, 20 at \$4.....	80.00
Subscriptions, 600 at \$3.....	1,800.00
Sale of back numbers and separates.....	150.00
Advertising	225.00
Interest on bank deposit.....	25.00
Total	\$4,030.00

By adopting the measures suggested above the receipts can doubtless be increased by \$600.

RECEIPTS

Balance on hand Jan. 1, 1919.....		\$2,518.12
Annual dues:		
1917	\$5.00	
1918	79.00	
1919	945.43	
1920	87.20	
		<u>\$1,116.63</u>
Subscriptions to JOURNAL:		
1918, Vol. 16.....	\$15.00	
1919, Vol. 17.....	1,372.77	
1920, Vol. 18.....	282.00	
		<u>1,669.77</u>
Sale of back numbers and separates:		
JOURNAL	\$110.00	
Proceedings	43.25	
Forestry Quarterly	83.50	
Separates	19.50	
		<u>256.25</u>
Advertising:		
By commercial institutions	\$81.25	
By educational institutions	96.00	
Miscellaneous	9.50	
		<u>186.75</u>
Society pins		16.64
Miscellaneous:		
Interest on bank deposit	\$44.94	
Refund on two telegrams	1.80	
Envelopes sold to Washington Section.....	.80	
		<u>47.54</u>
Total		<u>3,293.58</u>
Grand total		<u>\$5,811.70</u>

DISBURSEMENTS

Publication and distribution of the JOURNAL:		
Printing—		
Vol. 16, No. 8.....	\$337.45	
Vol. 17, Nos. 1 to 6.....	2,177.90	
		<u>\$2,515.35</u>
Composition of type for unused article.....	67.55	
Plates and line cuts	120.22	
Proofreading	190.00	
Envelopes for mailing	169.75	
Postage	83.77	
Mailing	17.50	
Stencils	8.02	
		<u>\$3,172.16</u>
Miscellaneous printing:		
Circulars and ballots	\$75.80	
Letterheads	5.75	
		<u>81.55</u>

Stationery and postage (exclusive of JOURNAL):

Paper	\$23.15	
Post cards	4.00	
Stamped envelopes	70.80	
Stamps	90.36	
		<hr/>
		188.31

Clerical and stenographic work		204.40
Operating addressograph machine		12.95
Telegrams		12.44
Express		3.20
Society pins		16.64

Miscellaneous:

Refunds on subscriptions, etc.	\$9.00	
Reprints from JOURNAL	6.75	
Dr. Fernow (Quarterlies sold in 1918)	26.75	
Filing box .....	.70	
Bank tax on Canadian check13	
		<hr/>
		43.33

Total		\$3,734.98
Balance on hand		2,076.72

Grand total		\$5,811.70
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ASSETS

Balance on hand	\$2,076.72	
Annual dues (28 at \$5)	140.00	
Advertising	58.75	
Sale of back numbers and separates	46.00	
Refund by author for unused article	18.00	
Postal deposit	8.56	
		<hr/>
Total		\$2,348.03

LIABILITIES

Annual dues paid in advance		\$87.20
Subscriptions paid in advance		282.00
Publication and distribution of JOURNAL:		
Vol. 17, No. 7—		
Printing	\$565.18	
Distributing	11.22	
		<hr/>
		\$576.40
Vol. 17, No. 8—		
Printing	\$581.15	
Distributing	7.92	
Proofreading	25.00	
		<hr/>
		614.07
Line cuts		4.00
		<hr/>
		\$1,194.47
Clerical and stenographic work		45.00
Dr. Fernow (Quarterlies sold in 1919)		83.50
Postage, telegrams and express		5.00
Printing membership cards		7.65
		<hr/>
Total		\$1,704.82
		<hr/>
Excess of assets over liabilities		\$643.21

AUSTIN F. HAWES,
Treasurer.

Audited and found correct by W. B. Barrows.

REPORT OF THE MEMBERSHIP COMMITTEE

During the calendar year 1919, 35 Members, 36 Senior members, and 14 Associate members were elected to the Society, as follows:

Members

Ancona, Edward P.
Benedict, M. A.
Brush, Warren D.
Chapline, William R.
Charlton, R. H.
Cronk, C. P.
Douthitt, F. D.
Dudley, Ernest G.
Haasis, Ferdinand W.
Hall, Jesse R.
Henderson, H. L.
Hill, Robert R.
Keithley, Everett S.
Krausz, Harry B.
Lamont, J. D.
Loveridge, Earl W.
Lyons, George W.
Mandenberg, E. C.

Millen, Frederic H.
Orr, George Raymond
Peirce, Earl S.
Richmond, Howard H.
Sampson, Arthur W.
Secrest, Edmund
Shepard, Harold B.
Sloane, Norman H.
Snyder, Thomas E.
Steffen, E. H.
Stubbs, Robert G.
Tryon, H. H.
Turner, Harry C.
Voight, Alfred W.
White, Donald
Williams, K. F.
Winslow, Carlile P.

Senior Members

Backus, Gordon T.
Bedford, John M.
Carlisle, George T., Jr.
Collingwood, George H.
Craig, Robert, Jr.
Dearborn, J. J.
Duthie, George A.
Fischer, Arthur F.
Fritz, Emanuel
Garvey, Clarence R.
Gould, Harry F.
Green, George R.
Guise, Cedric H.
Hoar, Crosby A.
Hilton, Huber C.
King, Rex
Kotok, Edward I.
Munns, Edward N.

Paul, Benson H.
Schaaf, Marcus
Schaefer, Oscar F.
Scherer, Norman W.
Schmitt, Karl
Schofield, William R.
Shepard, Ward
Show, Stuart B.
Talbot, Murrell W.
Treen, Lewis A., Jr.
Van Boskirk, Serrin S.
Volkmar, A. C.
Wales, Basil
Westveld, Marinus
White, David G.
Wohlenberg, Ernest T. F.
Wulff, J. V.
Wynne, Sedman W.

Associate Members

Carpenter, Warwick S.
Craft, Quincy R.
Dayton, William A.
Fuertes, Louis Agassiz
Green, Thornton A.
Harris, John T.
Jepson, Willis L.

Johnson, Bolling Arthur
Smith, Franklin H.
Speh, Carl F.
Sturgis, William C.
Tanner, Earl B.
Van Orsdel, John Pomeroy
Zimmerman, Conrad W.

The names of 51 candidates are now under consideration by the Executive Council. In this connection the procedure of the Council in passing upon candidates may be of interest to the membership generally. The member in charge of admissions receives all nominations, secures such supplementary information as in his judgment is necessary, and from time to time sends to Senior members and Fellows lists of candidates, with brief summaries of their qualifications. After suitable opportunity has been afforded for comment (at least 30 days), the names of candidates, with all available information regarding them, are sent to each member of the Council in turn for written ballot. Since it is impossible for the Council to meet as a body for the discussion of prospective members, this first ballot is regarded as, in a way, taking the place of such a discussion. Only those candidates receiving a unanimous vote are therefore considered as having been elected. The names of all others are sent the rounds of the Council for reconsideration and final action, provided, however, that if any new question regarding an individual's candidacy is raised on the second ballot his name is again resubmitted. Not infrequently it has happened that the second ballot has resulted quite differently from the first. The Council does not feel justified in electing a candidate to any other grade than that for which he has been proposed, with the single exception that candidates for Senior membership may be elected to Membership if in the judgment of the Council they do not qualify for the higher grade. All other changes, as, for example, Membership to Senior membership, or Associate membership to Membership, involve so wide a difference in qualifications that the Council feels that Senior members and Fellows generally should have an opportunity to express their views before final action is taken. Should three or more members of the Council, however, favor a man's election to another grade than that for which he has been proposed, their action is regarded as nominating him for the new grade and his name is so published in the next list of candidates.

For the assistance of members in proposing candidates, and for its own guidance in passing upon them, the Executive Council has expanded constitutional requirements as to admissions into a tentative statement of policy to be followed by it. This statement was published in the May (1919) issue of the JOURNAL OF FORESTRY with a request for comment and criticism. The response has been discouragingly small, especially as there is reason to believe that silence in this particular case indicates apathy rather than consent. No further action has as yet been taken by the Council on this statement, so that comment on it, whether favorable or adverse, will still be most welcome.

During the year the Constitution was amended to provide for a new class of members to be known as Corresponding members. These are to be persons who reside outside of the United States or its possessions, but who otherwise possess the same qualifications as Senior members. This new class of membership will make possible the affiliation with the Society of foresters in other countries who are not entitled to Honorary membership, and who were previously disqualified by residence for any other class of membership.

An attempt has been made to enlarge the membership of the Society so as to make it more representative of the entire profession by the inclusion of practically all qualified foresters. Each Section was urged to review the names of foresters within its territory, and forest schools their lists of graduates, with a view to determining whether there are not some who are eligible for election but who for one reason or another have not previously been elected. Largely as a result of this course a considerable number of nominations have been received and a list of some 90 candidates will be published in the near future. It is hoped that hereafter members will assume the responsibility of seeing to it that all properly qualified foresters of their acquaintance not already in the Society are nominated for the appropriate grade of membership. In submitting nominations members are particularly requested to make sure that all names are properly endorsed by at least three Senior members or Fellows, and that the biographies contain the information specified on page 624 of the May (1919) issue of the JOURNAL. This will materially facilitate the handling of elections and will save much unnecessary correspondence and vexatious delay.

S. T. DANA,

Member of Executive Council in Charge of Admissions.

REPORT OF THE COMMITTEE ON AMERICAN FOREST RESEARCH

One of the first activities of the Committee on American Forest Research was to secure recognition of forestry by the National Research Council. The members of the committee individually and the committee as such did all in its power to accomplish this end, and it is believed that the present recognition is in part due to these efforts. This recognition consists in the appointment of the Forester of the U. S. Forest Service to the Government Division of the Council, representation of the Society of American Foresters on the Executive Board of the Division of Biology and Agriculture, and in a Committee on Forestry which functions under the direction of the Executive Board. Forestry is thus assured a place in the first attempt to organize research in the United States on a national basis.

One of the activities proposed for the Committee on American Forest Research of the Society at its initiation was the compilation and publication of the research programs of all the agencies in the United States and Canada engaged in forest research. Work along this line, postponed during the war, was taken up immediately after the signing of the armistice. Compilation of the first general program was completed last fall and arrangements have been made for its publication by the Research Council. The response to the request of the committee for material was exceedingly gratifying, and in addition to the Federal departments of the United States and Canada, included about 40 States, Provinces, colleges, corporate organizations, and individuals. It is believed that the material furnished will result in a publication approximating 200 pages. In spite of the delays resulting from the present printing situation, it is hoped to issue the report before April 1. It is understood that the Research Council will distribute the published program very widely not only in the United States but also in Europe. It is hoped that the publication of the program will be very helpful to all organizations and individuals engaged upon forest research in showing what is under way, and that it will tend to stimulate forest investigations and to prevent needless duplication.

The Research Council has recently requested the various professional societies to form research committees which, among other things, are to act in an advisory capacity along the line of their own interest with the Research Council. The Society of American For-

esters by the formation of its Committee on American Forest Research anticipated this request, and in fact anticipated the formation of the Research Council itself.

EARLE H. CLAPP, *Chairman.*

WALTER MULFORD.

J. W. TOUMEY.

CLYDE LEAVITT.

E. A. ZIEGLER.

REPORT OF THE BOARD OF EDITORS FOR THE YEAR 1919

The literary contents of the JOURNAL for 1919 have reflected the trend of thought of our forestry world in regard to the subjects accentuated. While in the preceding volume hardly 16 per cent of its pages were devoted to discussions of subjects of a political character, the volume for 1919 gives nearly 40 per cent to such discussions, exchanging position with silvicultural subjects.

Undoubtedly the proposition of a national forest policy, set in motion by Colonel Graves, explains this fact.

Leaving 146 pages of notes and Society affairs unassorted, we find that the 868 pages of articles, reviews, and comment, roughly classified, share as follows in the contents:

Politics, education, and legislation.....	336
Management, mensuration and finance.....	196
Silviculture, protection, and extension.....	125
Utilization, market, and technology.....	96
Botany and zoology.....	35
Forest geography and description.....	33
Soil, water, and climate.....	24
Miscellaneous	23

868

During the year the printers, Judd and Detweiler, after having first increased the price of publishing the JOURNAL about 30 per cent, finally refused to handle the JOURNAL altogether. This necessitated the location of a new printer. Bids were submitted by Washington and outside printers and finally the one submitted by Milans was accepted. The cheapest rates which we could secure are still about 30 per cent higher than they were a year ago, and the regularity of the appearance of the JOURNAL is by no means guaranteed. With the high cost of publication and the budget for printing remaining practically stationary, it will be necessary to keep each issue of the JOURNAL within a 100-

page limit, including advertising matter. Meanwhile, the contributions to the JOURNAL, are increasing and it will tax the Editorial Board to accommodate all the articles that have been submitted for publication. The Board of Editors must warn, therefore, much as it regrets to do so, that authors contributing articles can not expect as prompt publication as was possible in previous years. One of the possible solutions would be to divert as many articles as possible, particularly of a biological character, to some other botanical journals. The newly-established organ of the Ecological Society may provide some room for contributions of an ecological character. Unfortunately, most of the botanical journals are also overcrowded and relief from that quarter may be very small.

For Board of Editors:

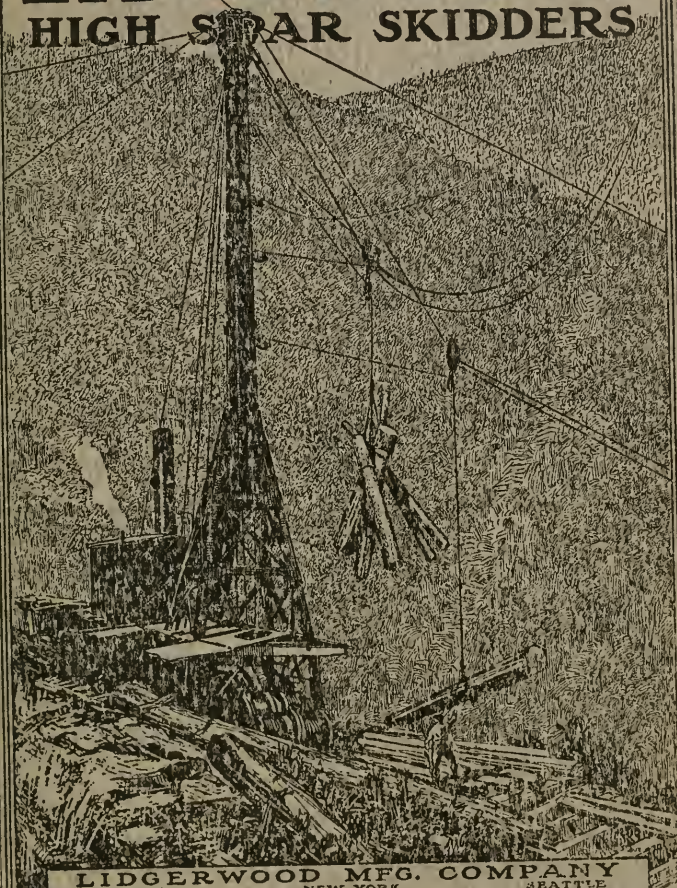
B. E. FERNOW.

R. ZON.

WINTER PROGRAM OF THE MISSOULA SECTION

- December 29—The Federal Government and the National Program of Forestry. J. F. Preston, in charge.
- January 5 and 19—The State in the National Program of Forestry. Supervisor C. K. McHarg, in charge for Montana, January 5. Dean F. G. Miller, in charge for Idaho, January 19.
- February 2—The Private Owner and His Problems Under the National Program of Forestry. Supervisor M. H. Wolff, in charge.
- February 16—The Classification and Determination of Forest Values Under the National Program. Dean Dorr Skeels in charge.
- March 1—The Acquisition of Forest Lands Under the National Program of Forestry, Major F. A. Fenn, in charge.
- March 15—Fire Protection and Its Relation to the National Program. Elers Koch, in charge.
- March 29—Forest Land Taxation in Montana and Idaho With Relation to the National Program of Forestry. Captain T. C. Spaulding, in charge.
- April 5—The Lumberman and Timberland Owner and the National Program. His Relations to Private Forestry. Huntington Taylor, in charge.

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JOURNAL OF FORESTRY

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AMERICAN FORESTERS

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A professional journal devoted to all branches of forestry

EDITED BY THE EDITORIAL BOARD OF
THE SOCIETY OF AMERICAN FORESTERS

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The JOURNAL appears eight times a year—monthly with the exception of June, July, August, and September.

The pages of the JOURNAL are open to members and non-members of the Society.

Manuscripts intended for publication should be sent to Prof. B. E. Fernow, at the University of Toronto, Toronto, Canada, or to any member of the Editorial Board.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Subscriptions and other business matters may be addressed to the JOURNAL OF FORESTRY, Atlantic Building, 930 F Street N. W., Washington, D. C.

Officers and Members of Executive Council of the Society of American Foresters for 1920

President, R. C. BRYANT, 360 Prospect St., New Haven, Conn.
Vice-President, C. G. BATES, Box 1068, Colorado Springs, Colo.
Secretary, PAUL D. KELLETER, Atlantic Building, Washington, D. C.
Treasurer, A. F. HAWES, Atlantic Building, Washington, D. C.

Executive Council

The Executive Council consists of the above officers and the following members:

	Term expires		Term expires
BURT P. KIRKLAND.....	Jan. 1, 1925	W. B. GREELEY.....	Jan. 1, 1922
S. T. DANA.....	Jan. 1, 1924	H. S. GRAVES.....	Jan. 1, 1921
J. W. TOUMEY.....	Jan. 1, 1923	B. E. FERNOW (<i>Chairman Editorial Board</i>)	



HENRY S. GRAVES

JOURNAL OF FORESTRY

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THE OLD ORDER CHANGES

Prophecy is an attractive but oftentimes dangerous undertaking. Nevertheless, there seems good reason to hold that the retirement of Henry S. Graves from the leadership of the Forest Service will be looked upon in future years as having marked something like the end of an epoch in the history of American forestry.

It is not merely that he was one of the very small group who in the last decade of the nineteenth century, after seeking their professional training abroad because no school of forestry had then been established in the United States, became the path-breakers for the great advance made in the first years of the twentieth, and that of those pioneers, with a single exception, all the rest have already passed out of the employ of the Government. Pinchot, Price, Olmsted, Griffith—and now Graves; to say nothing of such other veterans of the Service as W. L. Hall, Bruce, Kellogg, DuBois, E. T. Allen, C. S. Chapman, and others. Fortunately, of the contemporaries of these latter men a fair sprinkling still remains—and so also do the ideals and traditions, as well as the principles and established practice, which through transmittal guarantee continuity. The Forest Service will carry on; and it gains in stability through demonstration of its capacity to develop its own leadership. Nevertheless, it is probable that a turning point has been reached; that the chapter in the history of American forestry which opened with Mr. Pinchot's appointment as Forester in 1898 closes with Colonel Graves' retirement in 1920.

Two great achievements take up most of that chapter—the inception and firm establishment of the public forest enterprise, and the development of a decisive, clear-cut public sentiment for forestry. These two achievements were interlocked; each furthered the other, and neither could have been realized by itself. For in a democracy the only guarantee of permanence that a public undertaking can have is

popular approval and acceptance as a national policy; and national policy must be expressed in some concrete form of action or continuing activity before it can be said to have become accepted.

In 1910, when Colonel Graves took charge of the Forest Service, the National Forest enterprise still hung in the balance. It was standing on trial before the bar of public opinion; and no one could predict with certainty what the verdict would be. On the one hand, a strong sentiment in favor of forest conservation pervaded the country. On the other hand, a powerful opposition to Federal ownership and administration of great bodies of land in the Western States was fighting vigorously to break down the new system. The ultimate decision rested with the people of the West.

That decision has been rendered; and it has been given in favor of continued Federal administration because western citizens have become convinced that, under the test of actual experience, the National Forests work to their interest. To secure such a decision two things were necessary—time for a fair trial, and a handling of the Forests sufficiently capable, business-like, and wise to insure the approval of a public requiring to be shown. Both these things called for exceptional leadership on the part of the man at the head of the Forest Service, through the critical years that immediately followed Colonel Graves' appointment. Along with the name of Gifford Pinchot, who brought into being the administrative policy for handling them, will stand that of Henry S. Graves, as the man who consolidated the positions that his predecessor had won, and prevented the undoing of the work so well under way.

In short, these two have supplemented one another in a great common task. What the first began the second completed. Each was singularly fitted for his share of the task, and both were indispensable to its accomplishment. It is almost beyond the bounds of possibility that any other men than these two could have exercised the leadership necessary to bring the forestry movement in the United States to the position which it now securely holds.

Luck or destiny has smiled on the Forest Service. Two men in succession have had it in charge, each of whom was the one man for the task which fell to him; yet no one could have foretold with certainty when either of them took hold that he had it in him to make good as completely as both did. And inability to make completely good would have turned success into failure. They developed as they went along,

and by rising to each opportunity and emergency were prepared for the next. For a long time the eggs were all in one basket, and the strength of the basket was established only as it proved equal to carrying the eggs.

Fortunately, the most serious dangers that surrounded the Forest Service during the formative years of its history are now left behind. Never again is the National Forest policy likely to depend, for preservation from utter shipwreck, on the clear vision and sure judgment of a single helmsman. The gains of twenty-two years under two great pilots have brought the ship out of the shoals. Not, of course, into permanently fair weather. There is still plenty of need for strong and wise leadership. If at any future time the standards of National Forest administration should fail to be maintained at a high level, if ability to meet crises skillfully, to handle the business efficiently, to apply the best technical knowledge, and to assure an organization both capable and inspired by high ideals of public service, should ever be found wanting, the consequences would be very serious. But dissatisfaction with the work of the Service would take the form of a demand for its improvement, not its discontinuance. And the Service should be able to produce from within itself its own leaders. The National Forests are safe. They have become an integral part of the economic life of the country; they have won their place with the public; and they afford a training school for capable men.

Among the purposes with which Colonel Graves took office, not the least important in his mind was that of establishing the principle that the head of the Forest Service should be a trained specialist, qualified by technical knowledge to direct its work understandingly. Before his appointment was decided on there was reason to fear that a selection might be made of some one unfamiliar with the work of the Service and unconnected with the profession of forestry. His own selection not merely removed that danger; it put in charge of the Service, as was at once recognized on every side, the logical successor of Mr. Pinchot. From the standpoint of political expediency, which doubtless played its part in determining the choice, this was an eminently wise move. It amounted practically to an assurance on the part of President Taft that there was no hostility to the Forest Service, or purpose to halt its work, animating the Administration. In Colonel Graves, therefore, the Service obtained a chief who was not only a forester by training, but also, in the eyes alike of its members and of

the outside public, the most suitable person that could have been found to carry forward the great enterprise upon which it was employed.

His preparation for this task had been both broad and thorough. He was Mr. Pinchot's first disciple. They had become warm friends while both were undergraduates at Yale; and when Pinchot returned to the United States after having obtained, under the personal direction of Sir Dietrich Brandis, a thorough professional training in European schools and forests, where he was the first American to seek such a training, he soon induced Graves to follow in his footsteps. After preliminary work as a graduate student at Harvard in 1893-4, Graves went abroad, matriculating at the University of Munich. On his return to the United States he was associated with Pinchot as a consulting forester in New York, and in other work, including the writing of "The White Pine," which they published in 1896. The following year he made an examination of the Black Hills Forest Reserve, under appointment as a member of the U. S. Geological Survey, and was the discoverer of the *Dendroctonus* infestation, then in its incipency. On Pinchot's appointment as Chief of the Division of Forestry, U. S. Department of Agriculture, July 1, 1898, Graves became Assistant Chief of the Division.

His early work in Washington closed in 1900, with his selection to take charge of the organization of the Yale Forest School. Of his important services to forestry as the director of that school it is unnecessary to speak here. Down to 1907 he was also officially attached in various capacities to the Forest Service; and he was always in the closest touch with its activities. Thus when he became its Chief he brought to his new task ripened experience as an executive, intimate familiarity with the organization and work of the Service, extensive acquaintance with its personnel, and professional qualifications unexcelled in the United States.

It was emphatically in response to the call of public duty that he accepted the office of Forester. The situation which he had at once to meet was one of extraordinary difficulty. He had back of him, it is true, a splendid organization, full of enthusiasm and fighting spirit, eager for public service, hardworking, capable, and ready for any sacrifice. Also, it was an organization accustomed to win, no matter against what odds. The "esprit de corps" of the Forest Service was something unique in the Government. But the times called for a somewhat different strategy from that of the period through which the

Service had been advancing from one victory to another, and steadily conquering new fields. The whole conservation movement was on the defensive; and the Service had been its backbone. A political storm was raging, and one of its consequences was to bring in question the "loyalty" of the Forest Service. The political support which its policies had always been sure of in the Roosevelt days was greatly diminished, if not gone. The relations of the Service with the rest of the Department of Agriculture were wholly changed. Restrictions aimed at insuring closer control of its activities were being imposed, changes in organization effected, and brakes put on. It was necessary for its new Chief to prove his quality and win confidence in his judgment under the test of actual and repeated trial.

Partly because of what it stood for, partly because it had been and no longer was the upper dog, the Forest Service was in some quarters, within the Government, the object not merely of suspicion but of cordial antipathy. On the outside it had many and powerful enemies. It was hated for various reasons: because it typified the whole conservation movement, in the eyes of the public; because it was an extension of governmental control into a new field; because it stood in the way of many private interests; because neither its objects nor its workings had had time to become fully understood and were often resented as unnecessary and irritating innovations. On the whole, if the Service was to continue on its voyage and at the same time avoid the reefs that lay ahead, some skillful maneuvering was necessary.

As it proved, the new Forester was the right man in the right place. For one thing, he soon began to display an extraordinary quality of tact. He was gifted to a remarkable degree with the faculty of knowing what was in the other man's mind. He knew when to press an advantage and when to withdraw from dangerous ground; and he knew also when to surrender a non-essential and when to stand like a rock for a principle that must be maintained at all costs. Gradually he won his ground and gained the confidence of his superiors, of those with whom he came in contact, and of the country. His sagacity has been one of the most conspicuous elements which have entered into the successful conduct of the affairs of the Service. Had he not been a strategist of the type that he proved to be, the outcome could hardly have been the same. He saved the situation, and with little active support from outside his own organization; for politically the Forest Service was, for the first few years of his administration of it, little better than an orphan child.

This capacity to guide wisely, to wait patiently for a favorable opening and then to take advantage of it, demands a happy balance of qualities. It is as far removed from mere opportunism as it is from futile idealism. It requires a resolute but not an opinionated will; a flexibility of mind that avoids running head-down against a stone wall, along with a clear discernment of the objectives which must be attained; an all-round sanity rather than brilliance; the power to see far without overlooking what, because it is in the foreground, must be reckoned with first; a mind constructive without being visionary, and practical without being narrow. But successful leadership calls for more than the power to choose the right course. There must also be the power to organize; to judge men well; to enforce the will without riding rough-shod, in such a way as to secure the full co-operation and evoke the best powers of assistants and subordinates; and to infuse an organization with a sense of common purpose, the capacity for team-play, and the spirit of loyalty to its head. In an appraisal of the services rendered by Colonel Graves as Forester, the quality of his personal leadership of the Service and its results must be placed to the fore, along with his generalship in directing the strategy of the campaigns that have been conducted.

That the past decade has been one of very great progress in the development of basic knowledge through research and in the application of this scientific knowledge both in forest management and in methods of use of forest products is a fact familiar to all foresters. None the less, it is a fact which requires to be dwelt on when the significance to the forestry movement of Colonel Graves' incumbency of the office of Forester is under discussion. The entire history of the work of the Forest Products Laboratory at Madison falls within his ten years. No less important than the research work done at the laboratory has been that which has served to bring about the enormous advance made in the technical methods of handling the National Forests and the development of the science of American silviculture generally. The building up of investigative activities and their direction along the right lines must be counted one of the important achievements which stand to Colonel Graves' credit. Capacity to build up and rightly direct these activities is an essential qualification for the position of Forester, and this is one of the reasons why the ultimate success or failure of the Service is involved in acceptance of the principle that the head of the Service must be a forester.

Of the specific accomplishments which have signalized Colonel Graves' administration it is impossible to attempt here even a summary. Some of them are sufficiently recent to be fresh in the minds of all who read the JOURNAL—the handling of the Forest Service during the war, for example. The organization was maintained intact, the essential economic functions of the National Forests performed, and the investigative activities greatly expanded along lines which contributed important results to the war effort of the country; while a large part of the personnel was released for military service, the forestry operations of the American Army in France were organized, and co-operation was given the War Department in recruiting and officering the Forest Engineer Regiments. After the war, the readjustment to the new situation and conditions was accomplished without essential loss. Again, some of the achievements started earlier serve as landmarks of progress and are so outstanding that they rise at once to mind. Such, for example, was the carrying through of the land classification of the National Forests—a task inaugurated, in a way, before Colonel Graves took office, through the setting on foot of a general boundary examination, but one which expanded under his direction into a fundamental undertaking of much broader scope, which has settled once for all the vexed problem of agricultural lands within the National Forests, and stabilized the whole Forest enterprise by determining what classes of lands should be permanently retained and administered for Forest purposes. Such, again, have been the development of the land-purchase policy under the Weeks law, and its application in the building up of the Eastern Forests; the development of the land-exchange policy; and the working out of co-operative fire protection with the States. Still again, the policy of road-building for the development of National Forest resources and the benefit of local communities was his original conception, and owes its realization to his leadership.

Transcending all these in importance, however, is the great central achievement of putting on a sound and enduring basis the whole system of National Forest administration. A tentative experiment and glorious hope has been converted into an accepted and lasting reality. The usefulness of the Forests to the public, and their use by the public, have been vastly increased; the mechanism of administration has been immensely bettered; the technical methods of management have been put on a much more scientific basis; and the approbation of the public

has been decisively won. To have done this would by itself assure the man to whom primarily must be accorded the credit a permanent name. Alongside of this achievement, however, the future judgment of the profession and the public may place another—that of having inaugurated a new forward movement, of even greater importance for the country than that which has given us the National Forest policy; the movement for the extension of the practice of forestry to the privately-owned forests which must be saved from devastation if the needs of the country are to be in reality provided for.

The duty of carrying forward this new movement now devolves upon Colonel Graves' successor. The work which Mr. Pinchot laid down was taken up and completed by his first disciple, Colonel Graves, who now in turn leaves to his tried assistant and right-hand man, Colonel Greeley, another task. Worthily to participate in carrying that task to the completion which crowns the work, as well as to continue in the execution of the functions with which the Forest Service is now charged, will be the desire and ambition of its members generally. It is not enough to rest on what has been won; that would mean in the end stagnation and decay. It is the law of progress that

“The old order changeth, yielding place to new,
Lest one good custom should corrupt the world.”

H. A. S.



ALBERT F. POTTER

RETIREMENT OF ALBERT F. POTTER

On April 15 Mr. Potter resigned from the position of Associate Forester in the Forest Service. The announcement of this retirement, after nearly twenty years of continuous service, was received with genuine regret not only among the members of the Service with whom he has worked so long, but also in forest circles generally.

When the first Forest Reserves (as they were then called) were established in northern Arizona, Mr. Potter, at that time a successful stockman of that region, was selected by the Arizona sheep men to go to Washington as their representative and endeavor to secure some modifications of the regulations then in force for grazing live stock on the reserves. Mr. Potter spent some time in Washington in conference with officials in charge of the Reserves, who were so impressed with his ability that he was asked to join them and assist in working out the many problems that were confronting them in organizing and putting under administration the Forest Reserves then being established in various parts of the West. The opportunity for doing real constructive work was so attractive to Mr. Potter that on his return to Arizona he disposed of his stock interests and early in 1901 returned to Washington to become a "grazing expert" in what was then known as the Bureau of Forestry in the Interior Department. In 1904 he was made Forest Inspector. When the Forest Reserves were transferred to the Department of Agriculture in 1905 he followed their fortunes, and in 1906 was appointed Inspector of Grazing in the present Forest Service. In 1907 he became Assistant Forester, and succeeded Overton W. Price as Associate Forester on the former's retirement from the Service in 1910, which position he has since filled.

Although his position as Associate Forester brought new duties and responsibilities, Mr. Potter was always in close touch with the grazing work of the Service. His foresight and ability to grasp the details of difficult problems and resourcefulness in every emergency made him a tower of strength to the Branch of Grazing.

Seldom has any man had greater opportunities to do real constructive work on broad national and conservation lines as was offered Mr. Potter when he entered the work of the old Bureau of Forestry and few men in the Government service have surpassed him in their record of accomplishment. Here was an empire of public land which for many

years had been ravaged and ravished by the herds of the western stockmen. Its once splendid forage cover was almost gone, and erosion was tearing from the denuded mountain sides millions of tons of fertile soil, leaving only bare rocks and ruined meadows. On these areas millions of cattle, sheep, and other domestic animals were grazing where, when, and how they pleased. For many years the stockmen had used the public lands without let or hindrance. They felt it was theirs to use as they wished. They talked of "rights" obtained by such use and scoffed at any scheme of Government control over these lands even while they reluctantly admitted that unless some form of control were exercised the very existence of their business was threatened. Thus from the very inception of his work Mr. Potter faced a hostile and aggressive lot of stockmen who sought by every possible means to prevent the accomplishment of his plans for handling the situation.

Nowhere in the whole world had any government undertaken to institute a system of management of live stock using purely grazing grounds on even a small scale, let alone on lands aggregating more than 150 million acres and these consisting mostly of rough timbered mountain ranges, many of them unexplored, unmapped, and inaccessible. But under such conditions Mr. Potter seemed to gather strength and confidence rather than discouragement. Without precedent or guide of any kind he gradually evolved and carefully built up a scheme of controlled grazing suitable to such large scale operations. His infinite patience and never failing good nature disarmed most of the bitterest opponents of the scheme. His genius for organization drew to him a body of workers who shared his enthusiasm for the work and carried out his plans with zeal, loyalty, and tact.

Keenly alive to the need for co-operation with the stockmen, he promptly gave them a share of the responsibility of management, as fair a share as was possible and still retain in the hands of the Forest officers the final decisions as to principles and details of operation. It was not long before the tide changed and the stockmen, won over by his absolute honesty of purpose and good judgment, began to realize that in his hands their interests were safe and that the future of the livestock industry would improve rather than be injured by friendly co-operation in handling the grazing on the National Forests.

One of Mr. Potter's most successful acts was the fight to establish the right of the Federal Government to maintain its rules and regulations as against State laws. From the very first he held to the belief

that State laws could not govern the management of Federal lands and that the sooner the whole question was threshed out and a decision rendered by the highest court in the country the sooner the Government would be able to carry out its plans for the National Forests. Some of the best law officers of the Forest Service at that time rather doubted the strength of our position and questioned the wisdom of locking horns with the States on such a proposition. Never for a moment, however, was Mr. Potter dismayed at the opposition; not for an instant did he weaken or admit possible defeat; and the successful ending of the now celebrated "Fred Light case" was due more to Mr. Potter's dogged persistency "to see it through" than to any other single cause.

With the successful issue of the Light case came relative peace and harmony in the grazing situation, and today the Forest Service has no firmer friends, no stronger supporters than the western stockmen. Where once they fought bitterly to reduce the Forest areas they are now constantly urging either the inclusion of all the remaining public domain in the National Forests or else its management under regulations similar to those enforced on the National Forests.

With the feeling that the big pioneer grazing work of the Service has been accomplished Mr. Potter now turns over to those who will succeed him the further broadening and rounding out of his whole scheme of controlled grazing. That we shall miss his sound advice, safe counsel, and fine leadership goes without saying. Nowhere will his retirement be more generally regretted than among the stockmen of the West who will hear of his resignation with deep interest, feeling their industry has lost a loyal friend. With every member of the Service there is a feeling that we have each suffered a personal loss, for Mr. Potter's genial disposition and warm, sympathetic nature made him at once the friend and adviser of all.

It is also notable that although Mr. Potter came into the Service as a practical stockman, he has never allowed his enthusiasm for the Branch of Grazing and the interests of the stockmen to cause him to lose sight of the fact that the National Forests were primarily established for forest purposes and not as grazing commons. In all his management plans he has not failed to recognize the fact that the reproduction of the forests came first in any scheme of use and that the stockmen must accept this idea as fundamental and inviolable.

Mr. Potter has indeed been a pioneer. He has blazed out a trail which will never be effaced, and as long as the forests stand his work will remain as a monument to his persistency, tact, good judgment, and broadness of vision.

W. C. B.

THE ECONOMICS OF PRIVATE FORESTRY

BY BURT P. KIRKLAND,

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The stock argument of those who oppose handling private forest lands on a continuous production basis is that it is "uneconomic," meaning usually that the profits are insufficient. A great many misconceptions have arisen in connection with this point of view, hence it may be worth while to deal with a few of them, three in particular.

1. *The rights of private property.* Private property rights undoubtedly grew up because the granting of such rights was of service to society. Wherever such rights cease to serve or need restriction society will find a way to do so. The restrictions on management of forest land now proposed are far less costly and less radical than restrictions on some other types of business. The banking business is subjected to most rigid supervision (thereby through elimination of losses making it the most profitable in the country). Orchardists are compelled to spray and take other measures involving large expense. Innumerable other restrictions of private property could be mentioned. The safe conclusion in this regard is that the public is now fully determined that all of our large and prominent industries shall serve human welfare, an ideal not at all inconsistent, however, with profitable private management of the industry. It is indeed in many cases more consistent with private management than with public, since the latter is almost invariably so wasteful in the utilization of labor and capital as to make service impossible at reasonable cost. Prophecy is dangerous, but the writer ventures to predict that all industries will, within the next 10 to 25 years, be compelled to get on a basis of public service. This will be brought about either by voluntary private effort, by compulsory private effort, or by public ownership. One would think that foresighted business men would prefer the first method. So far as these principles apply to forest management they lead to continuous forest production on all suitable lands not needed for other purposes, as the industry most serviceable to human welfare, and hence the one that must be pursued. It is useless then to talk longer of the management of forests in other terms. To all intents and purposes

continuous forest production may be considered as the method of management of forests now to be adopted. All questions of capitalization, interest returns, taxation, etc., should be discussed in this light.

2. *Interest returns and capitalization.* These two questions are closely related. In a review of the Report of the Forester, p. 66, January, 1920, JOURNAL OF FORESTRY, "T. S. W., Jr.," states that European forest production pays only 2 to 5 per cent on the investment. This is, of course, a mere matter of capitalization. Much European capital being accustomed to 2 to 5 per cent earnings, the forests have become capitalized on that basis at several hundred dollars per acre. If European capital earned 10 per cent the forests would have been capitalized at something like half their present figure.

Under (1) of this article it was concluded that continuous forest production is the only thinkable future method of management for our forest lands. Capitalization must then be predicated on this assumption rather than on destructive exploitation as in the past. Economic conditions in all our commercial forest regions have arrived at the stage where forests organized in economic sized tracts will yield net revenue above all costs, including taxes, even on badly ruined tracts. This is true because where necessary forestry can be reduced to utilization and fire protection, thus keeping costs so low as to secure a net return even from a very poor annual yield. In the magnificent timber tracts of the Northwest large net returns are possible. The writer is familiar with a tract containing about 3,500,000,000 feet board measure which has for exploitation an average value for good and poor timber, accessible and inaccessible, of about \$1 per thousand, or a total of \$3,500,000. It will provide a sustained annual yield of 50,000,000 to 70,000,000 feet board measure with an average value of \$3 per thousand on account of the quality and accessibility of the stands first cut. (The average value of \$1 arises from inaccessibility of some parts of the tract.) After all administration, protection and taxes are paid, the net annual revenue will exceed \$100,000 per annum. *If 10 per cent is the right earning for capital the forest is now worth \$1,000,000 as a continuous production forest. Capitalized at 3 per cent it is worth about the same, as it capitalizes for as an exploitation forest.* This 3 per cent return is only a fraction of the total return to the owner from holding the tract under continuous production. Its situation is such that there is scarcely a shadow of a doubt that all stumpage standing 20 years hence will be worth \$10 per thousand. The amount

standing under continuous production will be little less than now. The return from "unearned increment" then to be added to the current return exceeds 10 per cent, making the total investment return in excess of 13 per cent. This is an exceptionally favorable tract. After the 20-year period has elapsed unearned increment will cease to play an important part and capitalization will have to be almost solely on the basis of the current return. The same will be true of other resources, so forest investments will be as favorably situated as others in that respect. In the Eastern forests the net returns will be typically less on account of their ruined condition in some cases. In others that have mature timber the capitalization for exploitation is too large to permit the net return to give a favorable interest rate. Since continuous production must hereafter be the standard method of management, capitalization must conform to it. Capitalization on this basis can often be harmonized with capitalization on the existing basis of exploitation, by the methods of cutting in the next few years. High capitalization can be reduced by removing first the valuable individuals, leaving the volume to be cut in future equal to that now but of poorer individuals except where growth can replace the values before cutting occurs.

3. *Taxation.* Complaint concerning taxation is loud and long. As a matter of fact under the general property tax timber owners in effect fix the amount of taxes by the valuation they themselves place on stumpage through buying and selling. In Washington taxation has been recently about $1\frac{1}{2}$ per cent on actual value. With stumpage buying and selling according to the opinion of stumpage values held by operators at about \$2 per thousand feet board measure, taxes would be about 3 cents per thousand feet annually. Stumpage is now rapidly advancing in price while the tax rate, it is certain, will not decrease. How can the timber owner consistently object to being taxed at the values he and his brother owners have themselves established by sale and purchase?

Considering the organized continuous production forest consensus of opinion as to value will again fix the valuation, and hence the taxes. How can objection be made to this? On what grounds should forest industry be favored in taxation over others?

Again, in the continuous production forest, there is annual revenue to meet the annual taxes. Providing taxation is equally just in each case there is then no difference between the general property tax and

a yield tax. The yield tax, though doubtless desirable, is necessary only to unorganized forests; in other words, improperly managed forests. It is further desirable during the transition from unorganized to organized forestry, but not an indispensable preliminary to forestry in any case.

4. In conclusion we may summarize:

(a) Hereafter industry will be judged in terms of human service. This means continuous production on forest lands whether the returns are as high as may temporarily secured from ruthless exploitation or not.

(b) Continuous production will yield net revenues whether on private or public forests in nearly all cases. The capitalization will depend on the interest rate. If a 3 per cent rate is chosen capitalization in a given case will be high; if a 15 per cent rate is chosen it will be low. Whatever the current return forestry by conserving the basic capital value of the property will for years yield a further percentage of return from "unearned increment."

(c) Valuation is fixed by the consensus of opinion of buyers and sellers. Taxation is on the valuation fixed. If valuation is wrong, and hence taxation, buyers and sellers should blame themselves, not tax authorities. Under organized forestry (the kind we want) taxation is essentially the same under general property tax or yield tax. Forestry need not, therefore, wait on tax reform.

SHALL WE CAPITALIZE OUR FORESTS?

BY B. A. CHANDLER

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Our forests should be raised on the investment basis—that is, they should be capitalized. This was the contention of the writer in an article entitled “A National Forest and Lumber Policy,” published in the *American Lumberman* of July 5, 1919. Subsequent discussion and study has made him feel more strongly than before the fundamental soundness and importance of his contention.

In the former article the writer took the position that it will cost money to grow forests; that this expense must be considered either an investment or a replacement; that if the private owner is to be compelled to practice forestry he must be allowed to do so on the replacement basis; that equitable application of the replacement method, although ideal ethically, will be nearly impossible; and that a workable plan can be developed if both the Government and the private owner grow their forests on the investment basis.

The discussion which has taken place since Col. Graves first called the attention of the public to the necessity of working out a National forest policy for private holdings, shows that there are certain fundamental questions which must first be decided before a definite policy can be formulated. Among these are the following:

Shall we hold to the old principle that the private owner shall have the right to the ownership and management of his property or compensation for the same when it is necessary that its management be controlled for the public good?

Is this generation under obligation to hand on to future generations a forest which is as free from the accumulation of capital expenses as the one it inherited?

Is the future forest to be grown chiefly by the Government, or is private capital to be encouraged or forced into the business?

These questions will be discussed later in connection with the different ways of financing the growing of forests.

There are several ways of carrying out the principle of replacement which also result in investments. Some readers may have failed to get the writer's meaning from his former article because the term “replacement” connoted to them something different than the meaning

which the writer felt was implied by the context. In order to avoid further confusion the reader will pardon a brief discussion of capitalization, depreciation, and the present methods of financing both private and public forests, before he proceeds to the discussion of the effect of different policies in regard to the above mentioned fundamental questions.

There are several different conceptions of capital and capitalization. In a strictly economic sense, all wealth is capital and all property is capitalized. Chapman¹ contends that "income is the key to capitalization" while Cole² contends that "no theoretical accounting aims support any view of capitalization other than cost." Both distinguish carefully between value and cost. One is speaking from the field of forest valuation, and the other from the standpoint of the accountant. From the accountant's point of view, cost is the only basis for original capitalization because capital assets must equal capital liabilities (costs). The costs charged to the capital accounts must be offset by capital funds which, in the case of a stock company, may be raised in one of three ways: Issuing and selling capital stock, borrowing, or issuing dividends in the form of scrip. By means of depreciation funds the capital liabilities are reduced as the property decreases in value. Thus the measure of the amount of capitalization at any time is the amount of the liability which is charged against the property. If the depreciation funds have not provided for the decrease in the capital liabilities as fast as the property has depreciated in value, the difference between the two must be charged off as a loss. Thus the importance of allowing for proper depreciation becomes evident.

The forms of depreciation for which a company in the destructive lumbering business must provide in order to protect the capital of its bond and stock holders, may be classified as follows:

1. Maintenance. This is really a cost of operating and is usually so charged.

2. Depreciation due to wear and tear. In some ways this is similar to the cost of maintenance, for if a plant is fully maintained this form of depreciation does not exist. When not needed in any one year, it may be put into a reserve fund from which replacements of worn out or out-of-date parts of the plant will be paid for.

¹ Chapman, H. H.: *Forest Valuation*. P. 46.

² Cole, William Morse: *Accounts: Their Construction and Interpretation*. P. 210.

3. Allowance for the depletion of the timber as it is cut. This is necessary unless the stumpage value of the remaining timber has increased sufficiently in value to offset the loss due to cutting, and this increased stumpage value is being realized in the increased 'price charged the manufacturing plant for logs.

4. Depreciation due to the fact that the plant is dependent on a wasting asset. In some cases the plant will wear out before its supply of raw material is exhausted. In such a case the depreciation due to wear and tear would exceed this one and completely cover it.

If an operating corporation wishes to grow forests, in order to lengthen the life of its operation, or even desires to put its operation on a permanent basis, it may finance the venture in the following ways:

1. By setting up an entirely new set of capital accounts. As far as the regular business is concerned, all the forms of depreciation listed above would continue necessary. The old land accounts would be credited with the value of the cut-over land and the new capital land accounts would be charged with it at the same value. The cost of formation and annual costs of taxes, protection, and carrying charges would be charged to these new accounts. The money for paying these expenses would be raised by the issue of more stock, bonds, or possibly by issuing dividends in the form of scrip.

2. By using the depletion allowance. In other words, no depletion allowance would be made because the forest would be maintained at its original value.

3. By using both the funds for depletion and the depreciation due to the business being based on a wasting asset. This is sound only when these funds are sufficient to establish permanent forest management or when enough extra capital is added so that a permanent supply of raw material can be relied upon. This is evident when one remembers that these funds were reserves which were necessary because the business did not have a permanent supply of raw material. Obviously, they must be held in reserve until a permanent supply is assured. The extra capital, if any is required, must be charged to capital accounts. This is practically the plan suggested by Kirkland³ and he is confident that it can be put into operation, under conditions, as he knows them in the West, without the use of extra capital, and that some of the

³ Kirkland, Burt P.: Continuous Forest Production of Privately Owned Timberlands as a Solution of the Economic Difficulties of the Lumber Industry. JOURNAL OF FORESTRY, Vol. XV, pp. 15-64.

depreciation may be saved for the business. In other words, he seems to think that the forest can be put under permanent forest management cheaper than the original capital can be maintained by depreciation allowances. This point remains to be proved, at least for our eastern conditions.

The first method suggested is a thorough-going investment method by which the future forest is fully capitalized, and is the method referred to in the previous article as the "investment method." The second and third methods correspond very closely to the method of allowing for replacements in a manufacturing plant, and from an accounting point of view, are in the truest sense replacements. At the same time they are also investment methods, for the reserves used are reserves of the original capital which have been reinvested. Whether the forests raised under these plans will be fully capitalized or not depends on whether the taxes, cost of protection, and carrying charges are charged to capital accounts or to the cost of production. There is still a fourth method which is being used.

4. By making allowance for all the forms of depreciation outlined above and also charging the cost of forming and carrying the new forest to the cost of production. This method is "neither fish nor fowl nor good red herrin." It is not a good straight investment for the expense is not charged to capital accounts, and thus, no new capital liabilities are necessary because of the expense. Neither can it be properly called a replacement for no previously invested capital is being replaced. If the business is operating under free competition, it results in the using of funds which should be divided among the stockholders or proprietors, and in an under capitalization of the business. It is an investment, resulting in the capitalization of the forest, in that these funds, had they been divided, might have been legitimately reinvested. It is a replacement only in the sense that any method which replaces the forest resource is a replacement.

In actual practice this method may be the result of indirect, dishonest methods of financing or the lack of well-defined policies on the part of the company concerned, or a concession to a public sentiment which demands forests but will not make it possible for private capital to grow them safely and legitimately.

In spite of the fact that this method seems to have little to commend it, a modification of it may be the only method of carrying out the desires of the public in regard to the future forest, and the funda-

mental questions raised at the beginning of this article. Graves suggests mandatory regulation of privately owned forest land. If the public decides that it is not going to dictate to any one class of men where they shall invest their capital, that this generation is going to hand on to the next a forest as free from the burden of an accumulation of capital expenses as the one it inherited from its ancestors, and at the same time requires the owner to practice forestry—a modification of this method must be used. This modification will consist in so controlling competition that the income from the sale of lumber will be sufficient to pay the stockholders a full dividend and at the same time defray the expenses of forming the new forest. The original capital will be accumulated in the depreciation funds and can be returned to the stockholders. No dividends will be withheld from the stockholders. The consumer of the forest products will pay for the formation of the new forest. The writer does not see any other way in which a capitalized business concern can produce a so-called “non-capitalized” forest, if indeed such a thing is possible. This is the method the writer referred to in his previous article as the “replacement method.” As has been shown in the above discussion, all other methods by which the production of the new forest can be financed requires the investment of new capital, the reinvestment of old capital, or the withholding of dividends. Therefore, they cannot be used if the mandatory principle is carried into effect without controlling the investment of capital.

Some of the forest financing practices of our State and Federal governments are also questionable.

The Federal government is doing considerable planting and is enforcing silvicultural regulations on National Forests. The planting costs are paid for out of appropriations, while the cost of the silvicultural operations are deducted from the stumpage receipts which are turned back into the United States Treasury, and no accounts are kept which result in the costs being charged against these forests as capital liabilities.

The State of New York is doing considerable planting and is purchasing a great deal of timberland. The cost of the former is paid directly out of appropriations. The money for the land purchase is raised by a bond issue, but since these bonds are retired through an annual appropriation, the result is the same except that the cost is spread out over a little longer period.

The writer does not know of a single State which is charging the cost of its planting and land purchase to the future forest as capital liabilities.

Furthermore, our governments have a tendency to subsidize the private growing of trees. Two States have already made appropriations providing free trees for the use of their citizens in establishing new forests. A similar law passed the New York State Legislature at the last session, but was vetoed by the Governor to cut down expense.

These tendencies may be good if the public has looked ahead, has counted the cost, has made up its mind to see the work through to a successful finish, and does not weaken when it begins to feel the burden. Before discussing the effect of continuing them, it is necessary to determine whether they result in a properly capitalized forest.

From the previous discussion of capitalization, it is evident that if the present discounted value of all expected future net income is taken as the basis of capitalization, these forests are capitalized. On the other hand, there are no capital liabilities charged up against these capital assets. These forests are under no obligation to return to the Government or to the taxpayers or their assigns, any given amount. The writer recently pointed this situation out to an accountant and asked him whether these forests were "non-capitalized," or what was the proper term to describe it. The accountant replied, "I should simply call it wrong and not try to find a term to describe it."

Right or wrong, some people make light of this situation. The claim that regardless of where the cost is charged on the books the cost of raising the forest is the same; that the future stumpage price will be determined by supply and demand; and that therefore, this situation has no effect on the safety of private capital invested in the growing timber. The writer admits that it may work out that way, but the history of our public domain shows that if the Government is a large holder of stumpage when the forests which are now being grown are ready to cut, the result may be very different.

Our public domain was obtained in part through the Louisiana Purchase; the settlement of the Oregon boundary; the treaty following the Mexican War; and the Gadsden Purchase, all of which represent actual expense of one kind or another to the Government. As far as the writer has been able to learn, all of these expenses were paid for out of income at the time, or were added to the general public debt to

be met from future income. Apparently, these lands were not charged with the original cost nor credited with the income received from them when sold to individuals. The demand on the part of the public to settle the West as fast as possible, and the desire on the part of special interests to get possession of as much of the valuable timber and other resources as possible, resulted in laws which turned vast areas over to private interests at nominal prices. Since these lands had no capital liabilities charged up against them, the receipts from them held no relation to their cost. Furthermore, they were put onto the market at such low values before there was a real economic demand for them, that land values in the East were forced down much below cost. In fact, this unsound development of the West caused a great deal of loss to land owners in the East who had invested in good faith.

Mindful of this lesson, one effect of the present method of financing the growing of forests is to deter private capital from investing therein. If in the future our governments are proportionally large holders of stumpage and this stumpage has no responsibility to discharge capital liabilities which are charged against it, the timber which has been raised as an investment by private capital is liable to have to be sold at a sacrifice. The history of the public domain, the selling of Government machinery left over from the war at less than private capital can manufacture it, and numerous other cases of unfair competition of the Government with private business, in response to a popular cry, all show this to be a real danger. If prices were extremely high, due to great shortage, there would be considerable pressure exerted to have the Government timber put on the market in order to force the price down. On the other hand, if there was an overload of stumpage, a condition we do not expect, the Government could apparently sell cheaper than the private timberland owner who had raised timber as an investment. This condition existed in the West for several years preceding the war. The Forest Service has been selling stumpage into a market which was already flooded with private timber. Knowing these facts, private capital is going to be slow in investing in the growing of timber as long as our Government forests are not charged with capital liabilities and while its officials are advocating a policy of mandatory regulation of private forest land which, as pointed out above, must result in private forests which do not have capital liabilities charged against them.

Another result of this method of financing is the lack of sufficient funds to carry on public forestry work. Any one who has tried, knows how difficult it is to get appropriations from either our State legislatures or Congress for growing of forests. It is almost impossible to get sufficient funds guaranteed over a long enough period of time so that a real constructive program for purchasing timberland, and planting waste land can be carried through. This is recognized by all concerned, and is the big reason why the necessity of working out some policy which will result in the practice of forestry on private holdings is felt so keenly today. There are many reasons, direct and indirect, political and non-political, for this condition, but these could all be overcome if the people really felt that they were getting value received for the money spent. The writer feels that the fundamental reason for the smallness of appropriations is that the people have no way of knowing the value of the assets which are being accumulated to represent the expenditures. The writer does not know of any financial statement by either the Federal or State governments which would enable one to judge as to the financial soundness of the Government grown forests. Reports are full of interesting figures as to the cost of details but there is nothing which corresponds in any way to the balance sheet and the income sheet which the ordinary business concern puts out.

A third result of continuing this method of financing the growing of Government forests, will be the necessity of putting the mandatory principle into effect. If private capital is not going to be attracted to the business of growing forests and the appropriations which the tax payer will vote to Government forestry departments are already approaching their limit—it follows, as the night the day, that the present landowner must be required to keep his land productive. The only other alternative is that we allow the situation to get so serious that private capital will be tempted into the business in spite of the danger of unfair competition with the Government. What is the cure?

The writer believes that the cure consists in making our Government forests responsible to the Government, or its citizens direct, for all the real costs which have gone into them. He believes that if this were done and the principle of expropriation was put into effect, it would not be necessary to make mandatory regulations covering the management of private timberland, and that considerable of the future forest would be grown under private management. There are several

different degrees of thoroughness with which this plan may be carried into effect. The writer believes that the more thoroughly the idea is carried out, the more satisfactory will be the results.

The simplest way of carrying this idea into effect would require little change, except in the system of accounting. The Government would be considered an individual interested in several lines of business, among them the growing of forests. The Government would be the proprietor of this business, and on the proprietor's accounts of the bureau, having the management of the forests in charge, would be credited with all moneys appropriated to the work of the bureau. All expenses which increased the capital assets of the forest would be charged to capital accounts. At the same time these accounts would be given credit for stumpage cut and depreciation on improvements. The proprietor's account would be debited with the net income from operating which was returned to the Government treasury and with the total cost of such work as research and education, which bring in no money income. The bureau would simply act as agent for the proprietor in carrying out these last mentioned lines of work and charge it with the total cost. In this manner the capital accounts would show the capitalization of the forests on the basis of cost and the proprietor's account would show the amount of the liability of the forests to the Government.

The advance is not very great, however, as long as the only record of this liability is a matter of bookkeeping. Books are too easily tampered with. Furthermore, books are not sufficiently before the public eye to prevent the politicians, representing special interests, from passing laws which would remove the evidence of the liability without the public being the wiser.

Therefore, the next step is to require all funds to meet capital expenses to be raised by bond issues. An incorporated business can raise funds to meet expenses charged to capital accounts in three ways only. It can borrow, issue and sell more capital stock, or issue dividends in the form of scrip. That is, it must issue some evidence of indebtedness in order to raise capital funds. For the Government to issue either scrip dividends or capital stock would require a different organization than we now have. However, it is perfectly possible to issue long term bonds to be retired when the timber is ready to cut. It would be necessary to issue enough extra bonds to furnish funds to pay the interest on the whole issue, for the forest can not pay dividends until

some merchantable material can be cut. Here would be an evidence of liability which could not be covered up by a little bookkeeping and would have to be met. If Government forests were taxed on the same basis as the private forests, as they should be, the private investor would be reasonably assured that the Government forest would not come into unfair competition with his own when matured. With this assurance the writer believes considerable private capital would be invested in the growing of timber. Furthermore, the amount of money the Government could raise under such an arrangement would be practically limitless. People will lend money for interest when they will not vote for money to be collected in the form of taxes from which they do not expect to get any money return. This being true, there would be nothing to prevent the Government from expropriating and growing forests on all forest soil which private capital does not keep productive.

The third step which the writer feels would be desirable, would be to separate the income producing and non-income businesses carried on by the Government. As long as such work as extension, research, and the growing of forests are carried on by the same bureau, there is going to be danger of false capitalization. When administrative individuals have been tied with red tape by the politicians, it is a temptation to use funds for one kind of work which needs doing and charge them to some other account on which there happens to be a surplus. Such dodging of red tape usually results in efficiency and better public service, and does no more harm than to make some cost figures inaccurate, when it is between non-income producing departments. When, however, manipulation takes place between capital accounts and the expense accounts for non-income producing work, it results in either over or under capitalization. Also more people would be interested in the accounts of the income producing departments than in the other, and they would be much simpler if not confused with a number of non-income producing accounts. Furthermore, the writer feels that a department which had charge only of capitalized business would be less open to pressure from the politician or citizen who wanted a job for his friend. Through the annual financial report, the efficiency of the department would be shown up too plainly. Also such a department would be less dependent on the politician and general citizen for funds to work with than the ordinary bureau. Such departments should be organized, not as a bureau, but as a corporation, the capital

funds for which are raised by Government purchased stock and Government bonds. A certain percentage of the stock might be sold on the general market.

This policy may be stated briefly as follows: Laws should be passed prohibiting the rendering of forest soil waste or non-productive, and providing that forest soil which is not kept productive by private owners shall be expropriated by the Government; that funds for this purpose shall be raised by Government bonds to be retired by the sale, when mature, of the timber grown thereon; and that all Government-owned, income-producing forests shall be managed by Government corporations which shall not be held responsible for any non-income producing lines of work.

And finally the writer believes that the situation of capital assets which have not capital liabilities charged against them is so fundamentally unsound that no great progress can be made until it is corrected.

PURPOSES IN FORESTRY

By PHILIP T. COOLIDGE

For correct planning, analysis of purposes is useful. Such analysis indicates that no serious disagreement exists at present as to the propriety of measures in forestry for purposes of recreation, for soil and water protection, or for military requirements. Expenditures for such purposes are proper if the projects promise to yield the most effective results possible, if the results anticipated are commensurate with the costs, and if the projects are clearly understood and approved by the public. The problem of timber for military requirements, a very large order under modern conditions, would receive valuable publicity if it could be worked out in detail co-operatively by the Government departments concerned.

To accomplish the above mentioned purposes, for which ordinary profits on wood production are not required, purchases of land for public ownership are useful, and governments have the undoubted authority to enforce restrictions on private lands, making due compensation to private owners if necessary in fairness. Regulations to prevent creation of serious fire hazards, dangerous to the property of others, may not involve compensation to private owners. On the other hand, present methods of cutting, which merely postpone the time of maturity of timber crops, do not necessarily constitute forest devastation, or any sort of irreparable injury to public interests.

As to the production of timber for ordinary commercial use, the theories generally advanced by those opposed to the radical changes proposed are essentially correct, because they are based upon unchangeable economic laws. Timber production for commercial use involves broad consideration of the employment of capital and labor generally. Effort in unprofitable projects, whether public or private, for ordinary industrial production is of no value either to the present generation or the next. The next generation will not find timber of "inestimable" value for commercial purposes—it will find it of exactly that value that it is willing to pay for. It will not be pleased to meet bills for timber growing, unless it can realize on that timber profitably. And for the present generation, future supplies of timber are worth

their expectation value, no more nor less, as figured at current interest rates and with sufficient insurance to cover the risks in a period as long as the rotation of a timber crop. The conditions under public ownership are more favorable than those under private ownership for the production of timber crops, but as far as timber production for commercial purposes is separated as a purpose in itself, projects under public ownership are justifiable only as they can yield profits.

There is much difference in the possibilities for practical forestry in our several forest regions, and the great fear which has been created by the Committee's report is that a crude uniformity of regulations, unduly expensive in comparison with results, will be forced on local lumbermen and foresters. Accurate discernment of conditions is especially needed.

What should be done is to secure adequate fire protection, more dependable taxation, and strong protection against any fraud or misstatement in timberland transactions and administration. The production of timber is a long-time project and requires strong, orderly functioning of the police duties of government, and consistent steadiness in financial conditions.

There is also a large field open for practical investigation. Markets, quantities of timber, growth, properties of wood, and its utilization, all call for investigation, and for live, current dissemination of detailed information. Conditions, such as future timber supplies, affecting each of the various wood-using industries, should be studied as separate problems for each industry, for, as has frequently been said, it is the industries which should be conserved. Satisfaction of human requirements, not merely the universal practice of silviculture, should be the aim.

Many projects in commercial timber production, if entered upon today, would undoubtedly yield satisfactory profits at the ends of the rotations. The practicability of the projects cannot be hurried, however, and it is unwise and unprofessional to urge commercial forestry on the nation in terms which lack impartiality, and which are alarming rather than reassuring to those who are endeavoring to bring about scientific, businesslike methods in industry and finance. Capital should flow freely to timber production, and it should be our business not to force this use of capital but to facilitate normal development by establishing the necessary safeguards.

The waste that now confronts us is due less to incorrectness of present general policies than to our haphazard prosecution of them. The public will support the right measures if they are not beclouded by secondary issues. The need of fire protection, for example, is spectacular enough to draw to itself the necessary support without recourse to side issues of educational value for forestry generally, which, it is hoped, will awaken interest in fire protection—after the snow has put the fires out. The way to stop fires is to urge fire protection, not something else. Furthermore, public support will not be endangered by the exercise of more scruple in the expenditure of public funds in many kinds of projects, such as control of insect and fungus attacks. The projects should be worth while and the costs commensurate with the value of the results.

There is plenty to be done, if we can agree on details.

COMMENTS ON THE REPORT OF THE COMMITTEE FOR THE APPLICATION OF FORESTRY¹

By DAVID T. MASON

The speaker feels that he is in full agreement with foresters generally and with many timberland owners as well in stating that the production of timber on a sustained yield basis must by some means or other be brought about on those lands in the United States which are best suited to timber production. The interests of the nation undoubtedly require that action be taken to bring about this object. The interests of individual timberland owners, while secondary to the interests of the nation, should be equitably treated in accordance with the guaranties of our Constitution. The important question for discussion is the means by which the continuous production of forest crops on forest lands may be brought about. The committee in its report suggests a plan. Will this plan produce the desired results promptly and in the most satisfactory manner in the long run? The speaker believes not.

Before discussing the proposed plan, however, it is desirable to refer briefly to the "Summary of Facts" constituting the preamble to the plan. The speaker is convinced that the preamble does not give a fair impression of the situation in a number of respects. Only two or three of the points in mind will be mentioned here.

The impression is given that the high lumber prices of to-day are due exclusively to the diminishing supply of standing timber, and that the application of the proposed plan will by some magic result in low prices to the consumer. It should be recognized that the high prices of to-day are due mainly to an exceptionally heavy demand for lumber at a time when stocks of the manufactured product are low and when it is impossible to produce and ship as much as is normally moved. The effect of the diminishing supply of timber on the present lumber market situation is slight indeed. When lumber production facilities become adjusted to the demand, prices will doubtless recede for simple old-fashioned economic reasons. During this period of high lumber prices stumpage prices have increased substantially, but still lag far

¹ Made before the Washington Section of the Society on March 11, 1920.

behind the lumber price increase; probably there will be no recession from the higher stumpage values, but rather a continued increase in stumpage values will be the rule. Neither the plan of the committee, nor any other plan, will prevent an increase in stumpage values. Foresters should welcome rather than express alarm at reasonable increases in timber values, for higher values are necessary to and tend to bring about the very thing which we all desire—continuous forest production. However, some sound public forest policy must be adopted to prevent stumpage from advancing at some future time beyond reasonable prices. Such figures have not yet been reached. Stumpage values of the future, as in the past, will be determined by the reaction of supply and demand, regardless of the particular form of ownership. Of course, as the report suggests, we should grow timber on a permanent production basis, so that large demand, coupled with inadequate supply, may not force prices to unduly high levels.

The report states that "The consumer suffers constantly by the persistent lowering of quality" of the lumber which he uses. The consumer's "suffering," if such it be, was and is inevitable regardless of the methods used in lumbering. Even if all cut-over areas had immediately been restocked in the past, we should still have to be satisfied with a lower quality of material than that obtained by utilizing only the best of the virgin timber.

For some reason the report drags in the exploded and discredited idea of a lumber trust or timber monopoly; just why is not clear.

Without discussion a few brief comments are offered on the proposed plan; the comments point out, more or less in the form of negative votes, those features of the plan which impress the speaker unfavorably; it is understood that such expression of opinion is desired. The development of Federal organization or control any further than proves absolutely necessary is not favored; it is believed that the committee's recommendations go unnecessarily far in this direction.

The speaker does not favor the requirements of a standardized accounting system, etc., organized under the Federal Trade Commission.

The organization of special machinery for handling the relations of the employer and the workman in the forest industries as such is not favored; no doubt something of the sort is desirable for industry in general, but it is not believed feasible or proper to take such action solely with respect to the forest industries.

The harvesting of the forest crop on National Forests by the Forest Service is not favored.

It is not clear that forest insurance agencies require specific authorization; such agencies are desirable, but can they not now be initiated without further authorization?

Whatever public forest policy is adopted should apply to timberland owned in wood lots as well as otherwise.

The report, in effect, lays the entire blame for the evils of the present forest situation upon the lumberman; it is implied that the timberland owner will never do anything on his own initiative, and that the only way to deal with him is at the end of a big paternal Federal club. A share of the blame, at least, should be apportioned to the public and the States, which have generally failed to bring about a situation with respect to fire protection and taxes under which it would be practicable for the forest owner to manage his property on a continuous production basis.

Our American civilization of to-day has been reached through the force of individual initiative, curbed only so far as necessary in the interests of society, rather than as the result of being hazed along by the lash of a far-reaching paternalism. The principle of individual initiative should not be exchanged for a bureaucracy, tending to mediocrity in its ability to produce results, unless and only to the extent that it is conclusively proven that individual initiative will not accomplish the purpose.

Action along the following lines is advocated by the speaker:

1. Federal legislation designed to encourage and assist the States in bringing about conditions under which it will be practicable for forest owners to manage their lands on a continuous production basis.

2. The necessary State legislation.

3. Give the private owner a fair opportunity, under favorable conditions, to take the initiative in putting his lands on a continuous yield basis.

4. Finally, by State legislation, force those who fail to do so voluntarily to adopt a system of continuous yield forest management or have their lands condemned by the State.

The speaker is convinced that there is a far better opportunity than the report indicates to secure hearty co-operation with timberland owners in carrying through a reasonable plan of action. It is believed that such co-operation secured in connection with accomplishing points

1 and 2 above, and accompanied by a careful study on the part of both the timberland owners and the foresters of the possibilities of forest production will result, in many forest regions at least, in many owners adopting a policy of forest production under point 3. With the possibilities then clearly demonstrated it should not be difficult, under point 4, to bring the lagards into line.

The speaker puts his faith in a plan of action such as that just outlined rather than that indicated by the committee for the following reasons:

Timberland owners have not and do not now destroy forests maliciously; their action has usually been logical in view of existing State law, local public sentiment, and the feasibility of continuous yield forest management as commonly understood.

Timberland owners are coming to see more and more clearly the national need for proper forest management; timberland owners, like other citizens, want to see public interests protected.

With higher stumpage prices and with an increasing knowledge of yields, rotations and other technical matters as yet only dimly understood, timberland owners are slowly awakening to the possibilities of continuous forest production under favorable conditions.

With State fire and tax laws properly adjusted and enforced so as to bring about the necessary favorable conditions, it is confidently believed that many timberland owners, especially the more important ones, will see the practicability and will voluntarily adopt sustained yield forest management.

With fair, straightforward co-operation between foresters and timberland owners, and this can be secured if the extremists in each group are avoided, it will be far easier to secure Federal and State legislation than will be the case if there is war between the two groups. We can get better results more quickly through co-operation than as the result of a fight. If all reasonable efforts at co-operation fail, then, and only then, it is time to fight.

FURTHER VIEWS ON THE COMMITTEE'S REPORT

MARCH 9, 1920.

THE EDITOR, JOURNAL OF FORESTRY.

I have read carefully and with much interest "Forest Devastation and a Plan to Meet It" and wish to offer the following:

One point it seems to me our Committee has not taken into account is the large numbers of private foresters working in the field today. It may be true results seem slow in developing, but they are being brought about nevertheless. The facts are certain that the largest owners of timberland today have their force of foresters and are to a great extent doing what they can to promote to future value of their lands to any extent that is consistent with good business policy. Further than this you could not expect them to go. The higher the value of the product the more this is being done.

The question of reforestation in the Northeast particularly has not as yet reached a business basis. Why should an individual pay ten dollars an acre to reforest when he can still go into the open market and purchase mature timber for the same price?

It seems to me the best policy to pursue is for the Forest Service to put competent men in the field in the various sections of the United States to study conditions and to consult with the various private foresters and timber interests. With this co-operation, which I believe would be welcome, a broad plan could be worked out in harmony. Definite recommendations could be made for each section and the private forester would have a better basis on which to work.

These policies or recommendations when they were decided to be of practical help to the country's timber interests could be put before the private interests and advertised sufficiently so that I believe they would be adopted in a very short time. Private interests with the money that they have invested in mills and timberland are not going to sit by and have some one tell them how much timber they can cut and in what way. They would, I believe, work on definite recommendations. I believe if some of the time which the Forest Service has put in in research work and other scientific data were expended toward the more practical end of forest management our timber situation would be in a better condition today than it is. We want definite policies and recommendations for the private interest to work on, but it is only

fair that we come out and say what these recommendations are to be and not leave them indefinite or delegate absolute power to some group of men to spring on them unexpectedly whether they are good or bad. Definite recommendations in definite regions should be tried as recommended first. If results are not obtained it would then be feasible to legislate by States.

In conclusion I will say that I believe a plan worked out along the lines of Professor Touney's reservations would be more acceptable and fair to all interests than the plan as it now stands.

Yours very truly,

GEO. T. CARLISLE, JR.

FEBRUARY 27, 1920.

PROF. B. P. KIRKLAND,
University of Washington,
Seattle, Wash.

DEAR PROFESSOR KIRKLAND:

Mr. Zon last evening called my attention to your article in the *Lumber World Review* for January. I think you will believe I am not merely critical and captious if I mention some points with which I do not now agree. I believe I am entirely ready to agree with you if possible.

In the first place I do not see how a man who believes in individual initiative in general, and as applied in this field, as much as you say in this article that you do, could sign the Pinchot Committee report as printed in the *JOURNAL* for last December. I am against the Pinchot report and in general sympathy with your position here, though I think you go farther with it than I do. But I can not see in your case the consistency.

Second, let me call attention to your second paragraph, first column, page 28, a computation of country-wide growing stock, and much the same which you made in reply to my article, "How Lumbermen in Following their Own Interests Have Served the Public," in the *JOURNAL* for March, 1916, and ask how you reconcile that with the paragraph on pages 919 and 920 of the *JOURNAL OF FORESTRY* for last December.

Third, it is a fact, is it not, that the statement by Mr. Kirby relative to southern pine resources, used by you on page 27, first whole paragraph, is now known to be largely in error and discredited? Rhodes

took the Kirby data as a basis for some thorough study of the situation, found when he first got hold of it that it was partial and wrong, and is about ready to publish results of his late work, which has cost, so he told me, some \$15,000.

Fourth, what basis have you for the statement that New England stumpage of any kind is worth \$50? I own some myself that I would be mighty glad to realize on it at that rate.

Fifth. I question the accuracy of your last sentence on page 27, looking at the matter not temporarily, but as a long range proposition. I had to quiet others in respect to the length they wanted to go in 1915 after our study of the stumpage situation, thinking it well not to go to extremes. In the same way I feel that you are going a little far the other way.

I will not take up any more specific points, but will make one further suggestion in a broad way. If you are so sure that forestry is the best paying thing in your region (you have been asserting it for some years now), it seems to me that you ought to be able to convince somebody who is in a position to put it in practice. There are keen and open-minded men among them. Why not focus on one or two and put the matter to the test? That is what I used to do when in Maine, and sometimes with this result—that I found there were holes in my own position. The effort was not thereby lost, however, for what was sound and practicable in the ideas, I had got sifted out and in something of a field actually put in practice.

Again, I say I am not captious in this matter, but solicitous for the truth and for sound progress based thereon. I am not taking public part in the discussion now going on, but I am in hearty sympathy with the effort Colonel Graves is making, took great satisfaction in a conference he and I had recently with a group of Southern lumbermen, and I think my personal work is contributing to progress more than I could do by writing. Just as I did in Maine years ago, now in the South I am trying to get things actually brought to pass—the practicable things that can now be done, the things that mean at the same time good business and conservation. I believe I am having some success at that, that this will lead to further advances, and I truly believe that we should get along faster if more of us were working on these lines at the expense even of some public discussion. Not that I think that needless, however.

Very truly yours,

AUSTIN CARY,
Logging Engineer.

MARCH 3, 1920.

MR. AUSTIN CARY,
U. S. Forest Service,
Washington, D. C.

DEAR MR. CARY:

I am glad to discuss the points brought up in your letter of February 27.

In regard to the first point: My signing of the Pinchot Committee report is most consistent in my judgment with my belief in the success of private forestry and in individual initiative in general. It is quite evident that individual initiative without some interference by governmental agency is destroying both the private forest resources and itself. Government action sufficient to preserve these resources will preserve the largest amount of individual initiative that can be preserved. Everybody, I think, recognizes that individual initiative will not do everything these days, and that there are many limitations on it. If we go over to Government forestry entirely, as many desire, it will be destroyed entirely in that field. If through legislation following examples of all Central and Western Europe, so far as adapted to our condition, we preserve private forestry as an industry, we have done all we can for individual initiative in this field, in my judgment. I would further call your attention to paragraph D on page 32 of the Report of the Pinchot Committee which specifically provides for the withdrawal of Government supervision wherever individual initiative or voluntary co-operation proves capable of taking entire charge of the forest.

Second: I have been aware all the time that the computation made in the report of the Pinchot Committee on growing stock is not the same as I have used in the past. I did not make that computation and, personally, I think it is a little high, but not enough difference between us for me to quarrel over a detail. Since they use 2 per cent as the rate of production of growing stock they are figuring on a 100-year rotation, while I figured on a 70-year average rotation, which gives nearer 3 per cent as a rate of growth. Of course, as you pointed out previously in a reply to my article, the data for this computation is none too complete, especially as regards the volume of young stock, and can not be made with absolute exactness. The evidence seems ample to me, however, that we already have a deficit in our growing stock, although I agree with you that the Pinchot Committee report estimate is a trifle high.

Third: The report of Mr. Kirby has been so widely quoted in the lumber journals and elsewhere, and out here on the Coast by some of the most prominent lumbermen, that I presumed it was authentic. Inaccuracies in it had not previously been called to my attention. I shall be very glad to see Mr. Rhodes' computation. I just had a letter from him, by the way, commending my article, in which he did not mention this point. However, it appears there is plenty of evidence that by ten years from now the South will need whatever timber production it can muster for its own industrial needs and will not be any great help to the rest of the country.

Fourth: I did not say that stumpage in New England is \$50. In my statement New England and the North Atlantic States were grouped together, and specifically, I found a price of \$50 per thousand for stumpage of basswood and cucumber in my native county, Chautauqua, in Western New York. I have also several times been told on good authority that stumpage prices of \$50 and more had been secured on old growth white pine in Michigan. I presume there is little, if any, timber stand in New England of a quality which would bring such prices. I would say further, that if the lumber prices obtained on hardwood as published in the *Lumber World Review* for January 10 are authentic, certainly high-grade logs, or even high-grade trees of certain of these species, should be worth \$50 stumpage. Otherwise, the logger and manufacturer of the stumpage would stand convicted as the most conscienceless profiteer in the world's history.

Fifth: I hold that there is no set of prices or anything else that will prevent a certain percentage of bankruptcies and failures in any industry, including timber holding. Under a system of individual initiative there is always a percentage of plungers in every industry, who overstrain their credit, practice unwise management, etc., which will, of course, in such cases bring disaster. If you eliminate this class the enormous profits made by lumbermen recently if used to place themselves in a conservative financial position by elimination of unnecessary borrowing, etc., will place them in an absolutely impregnable position for all time in the future. Of course the next financial depression, which may be expected along in two to five years, will undoubtedly put those with over-strained credits in some difficulties. The same would be true whether stumpage was \$25, \$100, or \$1,000 per thousand.

In regard to the next to the last of your paragraphs will say that we have had no men carrying on a campaign of the kind you mention here locally. As I have had to support the point of view that forestry was possible and profitable practically single-handed for the past several years, I felt it more necessary to educate the profession on this subject than anybody else. We have had to contend for several years with a large number of men in the profession doing their best to discredit forestry, but I think that situation is now rapidly passing. We intend to take up the kind of work you mention as soon as we possibly can, but my work here at the school does not leave me much liberty for traveling around the State.

I believe, as you say, that your work in extending forestry has been successful in New England, and believe with you that the leisure to carry on such work in the South would bring great results. It would be extremely useful if there were more men able to devote their time to this field, as I think, as you say, it is really the most hopeful field for immediate results right now because it is possible to convince the influential people who can get results at once.

Very sincerely yours,

BURT P. KIRKLAND.

ORGANIZATION FOR THE NATIONAL CONTROL OF FOREST DEVASTATION

BY FREDERICK E. OLNSTED.

The Committee for the Application of Forestry had no opportunity to discuss the details of organization through which its plan might best be executed. It briefly considered this matter, but only so far as was necessary to satisfy itself that the plan was workable under a fairly simple organization. The following outline, therefore, does not necessarily represent the views of the Committee. It is put forward upon my own responsibility and is intended simply to indicate some of the fundamental principles which might govern in framing the essential administrative machinery.

THE COMMISSION

The problem of forest devastation was considered to be too large a one and too complicated to be left in its entirety to any one executive department of the Government. A commission of final authority seemed advisable, and its makeup was designed to correspond to the problem in hand. Existing heads of departments were suggested, involving no additional expense to the Government on that score. The commission would not be an executive body. It would establish the basic principles of administration, determine standards for the control of forest devastation, and frame the fundamental regulations to govern procedure under the law. It would act as a board of appeals upon such cases as might be carried beyond the department heads.

It is apparent that the Committee's report has been misinterpreted in one important particular. The idea is prevalent that the plan would necessitate the creation of a large new administrative body, under the new commission. Such an impression is wholly wrong. The plan contemplates merely an extension of the Forest Service organization, placing executive control with the Forester. The establishment of the commission suggested would no more involve new administrative machinery than did the commission created under the Weeks law.

THE FOREST SERVICE

The Forester would be the chief executive officer, acting, of course, under the Secretary of Agriculture. That would mean a single executive head for the nation-wide job. All existing forces of the Forest Service would be at his disposal, and could be augmented as occasion required to accord with his greater field of work.

The keynote of the new organization should be decentralization, with the greatest possible authority in local hands. The job should be done on the ground. The administration would be regional, the regions corresponding to the principal economic forest types of the country, with regional foresters in charge. A revision of the present district lines of Forest Service organization might be found advisable. In regions where National Forests occur these might be placed in charge of district foresters under the regional foresters. Necessarily large at first, the regions might later be sub-divided as funds and men become available; or as organized forest units prove themselves able to stand upon their own feet in preventing forest devastation, regions or parts of regions could be eliminated from Government control.

At the start the field organization under the regional foresters would necessarily be of a flexible sort, something fitted to apply rough and ready measures and something capable of being moulded into a more perfect organization as time goes on. For example, there might be simply a corps of forest inspectors in each region, a body of men mostly on the go from one group of operations to another, explaining the requirements and reporting upon how they are carried out. Most of these inspectors, perhaps, should be practical woodsmen with a brief but fundamental training in forestry. At the beginning of things we should expect a situation such as we had when we started to manage the Forest Reserves with a handful of men and inadequate funds. That state of affairs righted itself in a remarkably short time, and within a few years the administrative machinery became reasonably efficient. Moreover, we should proceed upon the theory that the regulations, when understood, will be willingly complied with even in the absence of inspectors. The less supervision the better.

As the organization gradually took shape, it might develop that machinery similar to that now applied to the National Forests could be used successfully. Resident forest supervisors might be placed in charge of districts with forest rangers under them assigned to the

larger individual operations, or to groups of operations. Authority should be placed where it belongs, right on the ground.

STATE FOREST FORCES

Under the Forest Service plan for State control the State Forester would be the sole executive officer. Under the national plan of control, one of the problems to be solved is how the various State forest forces might best work with the National Government. To many this appears as a serious stumbling block; to the Committee it appeared as a problem which would, before long, settle itself. It would be futile to draw up any general plan suited to all States, for the forest laws and organizations of no two States are the same. It would doubtless prove advisable to consider each State separately, making such arrangements with each as would best fit the local conditions. The history, aims, and desires of each State forest organization should receive the most careful consideration.

Protection against fire is a problem of first importance. Under the plan for State control, as now proposed, both silvicultural measures on lands being logged, and measures for fire protection not only on lands being logged but also on cut-over and virgin timberlands, would be in charge of the State Forester, who would work under State laws. There would be no division of authority as between silvicultural measures and protection against fire, and the latter could be regarded as a part of silviculture itself.

It is argued that under the Committee's plan for national control there would be a break in administration, Federal officers having charge of silvicultural measures on lands being logged, State officers supervising fire protection both on lands being logged and on all other logged and virgin timberlands. Conflict in plans and administration would result, it is claimed.

Suppose we get down to brass tacks on this matter. The plan for State control does not contemplate giving the States a free hand, by any means. The States are to be subsidized by the National Government, the latter contributing to the costs of preventing devastation. In return, the States would be compelled to conform to certain standards, both in the measures to be used and in the efficiency with which they are applied. That calls for constant inspection and supervision by the Federal Government, and the withdrawal of the subsidy in case a State fails to live up to the Federal standards. It is proposed to

bring State officers under nominal Federal control by deputizing them to act as Federal officials. Such nominal control by the Federal Government would admittedly be weak and provokative of friction.

Would not the situation be distinctly better under the Committee's plan for national control? Silvicultural measures on lands being logged would be controlled directly by Federal officers under Federal regulations, and in that respect the plan would certainly be much stronger. The basic anti-devastation measures would be applied throughout the whole country, through one organization, under one executive head. That would seem to be the one thing of vital importance because it makes sure that something will be done.

But, it is argued, if State forces are to be used for fire protection and Federal forces for silvicultural work, it means indirect Federal control over fire, a thing so closely related to the successful practice of silviculture as to demand undivided control. The answer is that the National Government would have precisely as much to say about the State's plans for fire protection and the State's efficiency in applying those plans as under the Forest Service program; for the Committee contemplates the same Federal subsidies, justifying the same degree of supervision through the Federal deputizing of State officials. In either case Federal funds, naturally, would not be forthcoming until the State's plan for fire protection was so framed and its forces so organized as to tie in satisfactorily with the plans of the National Government to control devastation where forests are being cut. Both the Committee and Forest Service plans, as thus viewed, necessitate close co-operation between the National Government and the States.

Here is the main point, however. The Committee's plan places the key to the whole situation—the right and power to enforce fundamental measures against forest devastation—directly in the hands of the National Government. Once the law is enacted there will be driving power behind it throughout the nation. Under the Forest Service plan many different laws would have to be enacted in many different States, and nothing at all would happen unless and until the States themselves cared to act. In yielding to local option the hope of real achievement would be submerged.

Another suggestion is this. In many of the Western States private owners of timberlands have for some time past turned over their properties to the National Government for protection against fire. Owners within or adjacent to the National Forests do this under "co-

operative agreements." The owner pays the National Government a certain sum each year, sometimes estimated on a per acre basis, in return for which the Government takes entire charge of the work of fire suppression on the property, placing Federal rangers or guards on patrol, and directing the work of fire fighting when fires occur. In many States the aggregate area of private forest land under Federal protection is no small part of the total forest land privately owned. It is conceivable that in some States, upon requests from the States themselves, this system might be applied successfully to all commercial private timberlands, Federal fire wardens being appointed locally and upon the recommendations of town, county, or State governments. If the States and the owners should invite Federal fire protection on private holdings, would there be any valid objection to such a plan? The method of raising funds from the owners and the States is a detail only, best settled as local conditions dictate.

Of course a plan of that description would reduce the problem of organization to very simple terms indeed.

ADVISORY BOARDS

Under the plan for national control it would be possible to create and sustain a substantial local interest in local forest affairs. One way of doing this successfully would be to sanction and encourage the establishment of advisory forest boards. Such boards would meet with the regional foresters on regional forest matters, and local boards could be formed to advise with forest supervisors and other local forest officers. On these boards might be representatives from lumber associations and wood-using industries, directors of forest schools, presidents of State agricultural colleges, and public spirited citizens in general. In the national control of grazing, advisory boards have proved invaluable.

BUSINESS PROBLEMS

The Federal Trade Commission and the Department of Labor would handle all those business phases of the work included in the general plan, such, for example, as the co-operative combination of lumber manufacturers, the control of production, reports on the business conditions of the industry, and the formation of industrial councils. The Forest Service would be concerned with these subjects only in so far as they might have a direct bearing upon measures for forest

perpetuation. The reasons for including such matters in the Committee's plan will be explained in a later article.

WITHDRAWAL OF CONTROL

The opponents of the plan have generally overlooked the clause which provides for the withdrawal of Government control whenever an organized forest unit has proved its ability to stop forest devastation. The Committee considered this provision to be of far-reaching importance, and looked upon it as a guiding principle. It expresses the belief that Government supervision of the lumber industry, whether Federal or State, is a necessary evil, a thing to be enforced only so long as may be essential to bring the operations of the industry into harmony with the public interest. While convinced that injuries to the public welfare could be remedied only through compulsory and nationwide legislation, the Committee believed that the lumber industry should again be given a free hand to work out its own salvation as soon as it had shown itself willing and able permanently to keep its forest lands productive. By "organized forest unit" is meant any large holding of commercial timberland, or a group of such holdings, or a natural economic forest unit, such, for example, as the Puget Sound district, or the Idaho-Montana white pine district, or the Northeastern spruce district, or parts of such districts. The size of the units was considered of minor importance, the idea being that whenever a forest area was made continuously productive, thus insuring industrial permanency, Government supervision should be withdrawn.

THE REGULATION OF WOODLOTS

It has been argued that there is no good reason for excluding farmers' woodlots from the operation of the law. The Committee thought that it might be wise to exclude them, at least in the beginning, for two reasons. First, their control was considered impracticable from the administrative point of view until the organization had matured. Second, the average farmer is not inclined to devastate his wooded property. He endeavors to keep trees growing upon it and, in a rough way, he usually succeeds. The difficulty of drawing a line between farmers' woodlots and commercial timberlands, especially in parts of the South, was recognized; but the Committee regarded this as a detail for which a fairly simple solution could be found.

A LESSON IN FOREST ECONOMY

BY THEODORE S. WOOLSEY, JR.¹

Dr. Wilson Compton's fourteen points, published by the *American Lumberman* as representing the views of the Secretary-Manager of the National Lumber Manufacturers' Association, are surely to be as little followed in actual practice as were the fourteen points of our foremost peace negotiator in Paris—but for different reasons. From the broad economic viewpoint, Dr. Compton's points were unsound and were not based on a solid foundation but were held by some to be practical because they attempted to continue present conditions; the President's fourteen points were sound and were based on the solid foundation of justice and humanity but were held to be somewhat impractical because they ran contrary to the self-interest of the Great Powers. To my mind both Dr. Compton (and his backers) and certain allied Premiers fail to have vision; the next fifty years will do more for "the people" and for the small defenseless nations than did the last half century. A lasting and successful era of industrialism, which is upon us, must be based on justice to the majorities as well as protection to the minorities or the whole structure will crumble. The lumber industry has become an important part of our national economic life, and with the acute lumber shortage that exists today wise decisions are necessary. Will the operator be satisfied with reasonable profits distributed over a number of years or will he prefer to reap his harvest in a decade? The lumberman may think it is vital to cut out his holdings as rapidly as possible (in many cases it may be so far as his pocketbook is concerned) but the ownership of forests, according to the forest history of older nations, carries with it an obligation on the part of the State to see that mountains and planes are not laid waste, because forests affect fundamentally the economic welfare of communities and States, and we can be certain the United States will not shirk its duty to pass restrictive legislation when necessary. Let me quote from the forest laws of Algeria which are almost identical with the forest laws of France itself:

ART. 99.—Clearing can only be opposed in case the preservation of the woods is recognized as necessary:

¹ Rights to reprint the eleven points are reserved by the writer.

1. For the maintenance of lands on mountains or slopes.
2. For protecting the soil against erosion and the encroachment of rivers, streams, or torrents.
3. To insure the existence of springs or water courses.
4. For the protection of dunes and shores against erosion by the sea and encroachment by the sand.
5. For the defence of territory in the frontier zone which shall be determined by a regulation of the civil authorities.
6. For the sake of public health.

ART. 100.—In case of any violation of Art. 98, the person who shall have effected, or caused to be effected, the clearing shall be sentenced to a minimum of 200 francs (\$38.60), and a maximum fine of 500 francs (\$96.50) per hectare (2.5 acres) of woods which have been cleared.

Moreover, if ordered so to do by the Governor General, he shall replant the areas denuded within three years.

ART. 101.—In case the owner does not carry out the planting or sowing within the time prescribed by the order of the Governor General, the Waters and Forests Service can see that it is done at its own expense upon previous authorization from the prefect who shall order a memorandum of the work drawn up and the cost levied against the owner.

ART. 102.—The provisions in the four preceding articles are applicable to sowing and planting executed in accordance of the Governor General's decision, for the replacement of denuded woods.

ART. 103.—The following are excepted from the provisions of Art. 98:

1. Young woods during the first twenty years after their sowing or planting, except in the case set forth in the previous article.
2. Parks and gardens either fenced or adjoining habitations.
3. Woods not fenced, less than 10 hectares (24 acres) in extent, on condition that they do not form part of another wood which would bring up the area to 10 hectares (24 acres), or that they are not situated on the summit or slopes of a mountain.
4. Those portions of forests which the owners have been authorized to cut down in virtue of Art. 9 of the decree of Feb. 2, 1870.
5. The land which has been reserved as woods and forests included in areas (set aside for) colonization.

ART. 104.—Excessive exploitation, grazing after felling, coppicing operations or fires, which may cause the total or partial destruction of the forest in which they are practiced, shall be treated as deforestation, and in consequence those set forth under Arts. 100 and 101.

Why was such a law possible in a country so intensely democratic? Simply because the law-making bodies found it was *necessary for the good of the State*. This is wise economics as well as just legislation. I believe therefore that sooner or later the timber owners of the United States will meet the issue squarely and justly.

In France about one-tenth the forest area belongs to the State, two-tenths to communes and public institutions, and seven-tenths to

private owners. *There are an incredible number of small owners*, a fact never before noted by English or American writers. In 1912 there were 1,538,526 private forest owners² (excluding the communes, which are really groups of small joint owners). There were no less than 1,446,200 owners with less than 25 acres, only 82,285 owners with forests of 25 to 1,235 acres, and but 742 owners of forests over 1,235 acres. This is of the utmost importance. It is the key to the stability of France. In other countries the forests are usually in the hands of large owners; in the Republic of France the forest land, as well as the agricultural land, is divided among the people. There are few large estates remaining. Out of all the private forests there are only 79 over 2,500 acres; in 21 departments there are none this size. In the United States there are millions of farmers owning small woodlots, but according to the Society of American Foresters:

"A few men have secured vast amounts of private timber and timberlands. Already 1,802 owners control more than 79,000,000 acres of the forest lands on the United States. In Florida, 182 holders own more than 9,000,000 acres. In Michigan over 5,000,000 acres are held by 32 owners. In Louisiana 27 holders own more than 6,000,000 acres. *In the Pacific Northwest, three owners have more than 9,000,000 acres.* And these are but typical instances."

From the national and political standpoint, France is unquestionably the gainer by having her forests in small holdings. From the standpoint of forest management and the treatment of individual stands, small ownership necessarily implies that each owner will cut spasmodically to satisfy his needs in the village or farm. The large owner, on the contrary, upon competent technical advice manages his forest as a permanent business and adheres fairly well to a sustained annual yield and to regulated fellings. Other things being equal, *having forests in small holdings benefits a nation but deteriorates the stand.* Thus the responsibility of large owners is emphasized. In the United States they have thus far failed to live up to their responsibilities and when the concentration of ownership is widely known the public will take a hand in preventing the destructive logging of these large areas.

Can these few owners afford to fight measures that are aimed at the benefit of the nation? Our economic supremacy, which has been emphasized by the Great War, was based not on the individual's success in business but fundamentally on the natural resources which were

²The figures of the total number of owners, given in the official French Forest Atlas of 1912, do not check with the owners under the various size classes. This discrepancy cannot be explained but does not affect the conclusion.

obtained almost for nothing. Can we afford to destroy an important natural resource with our eyes open? I say No, without hesitation. If we admit that forests yield (*a*) direct financial benefits to the individual and (*b*) indirect benefits to the people who control the nation, it is clear that the best policy for (*a*) the individual is to co-operate with (*b*) the public. Dr. Compton would have been on firmer and safer ground if he had advocated the following simple policy:

A. Increase very largely the acreage of public forests (and secure liberal appropriations to make this possible).

B. Restrain the individual in the destruction of his property where it injures the public, but co-operate with him, in return for the indirect and direct benefits received, by wise taxation, by protection, and by just legislation.

"An Answer to Dr. Compton's Fourteen Points" was given by X. in the December, 1919, *JOURNAL OF FORESTRY*. Those who still believe in the fourteen points would do well to read the arguments presented by an anonymous writer, and the time has come when it will pay the lumberman to be well informed. But to my mind the best constructive answer and argument is to give sound forest economics side by side with what is clearly fallacious, shallow, and unsafe. This I have done in the table below, and it should be noted that the eleven points are based largely on the forest history of France—a sister republic—and on French forest policy. Unquestionably there are exceptions to these principles but it is believed they are quite generally correct for the temperate zone, and contrasted with Dr. Compton's economics they constitute a good lesson. But when we come to apply these to the tropics there is much that is doubtful. For example, Dr. Huntington of Yale University, in his book on "The Climate Factor," showed that in Guatemala probably the increase in rainfall and the growth of tropical forests tended to destroy the then existing civilization rather than to build it up!

DR. COMPTON'S FOURTEEN POINTS.

1. "There are already local shortages of standing timber and there will be more. The removal of the original forests from the soil of the United States without provision for forest renewal on much ('most' in American

SOME SOUND FOREST ECONOMICS.³

1. No great nation can prosper without controlling forest destruction and without practicing forestry. Decadent nations (outside the tropical zone about which we know little) have no considerable areas of valuable for-

³ From "Studies in French Forestry," soon to be published by John Wiley & Sons, 432 Fourth Avenue, New York City.

Forestry) of the land thus cleared is not necessarily a public misfortune.

2. "Possession of cheap and plentiful standing timber is not necessarily a symptom of national wealth.

3. "The virtual disappearance of certain species of timber is not necessarily detrimental to the public welfare.

4. "The cutting down of old trees faster than new trees are growing up does not of itself signify public loss.

5. "Not only is it not necessarily, but it is not even probably true, that all the lands in the United States locally determined to be better suited for growing trees than for growing anything else, should be used for growing trees.

6. "The disappearance of forest industries in certain regions because of exhaustion of nearby timber supplies is not necessarily either a local or national misfortune.

7. "Economically the original timber in the United States is in large part a 'mine' and not a 'crop.'

8. "Local shrinkage of employment for labor, caused by vanishing forest industries in certain regions, has been by no means an unmixed evil for labor.

9. "Idleness of some of the cut-over timberlands is the temporary result to be expected of clearing the forests from lands upon which maintenance of permanent forest growth would be poor public economy, because involving relatively wasteful use of the soil.

10. "Idleness of other of the cut-over timberlands is the inevitable result of clearing the forest from lands upon which regrowing of a new forest would be poor private economy.

11. "The owner of private property in timberlands, legally acquired, is under no different or greater public obligation permanently to use his land to grow timber than the obligation of the owner of agricultural land to use his land to grow farm crops if the growing of such crops is unprofitable.

ests, either in public or private hands. Under modern civilization decadence and widespread, permanent devastation of an existing forest resource are inter-related, especially in localities with somewhat deficient rainfall. With forest devastation the local population on potential forest areas decreases.

2. From the national economic viewpoint the *indirect benefits* of forests have a bearing on the nation's health, climate, and general prosperity.

3. The financial returns or direct benefits from *permanent forest production* are usually less than the average net profits secured from other forms of conservative business, and the risk of growing forests is considerable—the more extensive the conditions usually the greater is the risk. But in some cases private forests can be handled properly as a conservative investment provided the economic conditions are satisfactory and provided technical and financial assistance is given by the State.

4. If forest production and an equitable annual yield is to be sustained obligatory regulation is essential, not only in private but also in public forest management, but the success of mandatory forestry on private land is very doubtful if the owner maintains his forests solely for its return in money, unless the State co-operates.

5. Where private owners are not restrained by law and where the sole aim is immediate financial profit, their forests are usually destroyed and during the process of disintegration often constitute a public menace. This rapid realization of growing stock or capital is because the forest is usually a poor permanent investment and because of the inherent human tendency toward rapid gain.

6. The far-reaching results of forest destruction are often slow in making themselves felt, but are cumulative in their adverse effect on the public interests. The correction of forest denudation is so slow and so exceedingly expensive that most if not all mountain forest areas should be controlled by the State.

12. "The legal obligation upon the owner of property—an obligation that is universal and should be enforced—so to use it as to do no damage to another's property and to do no public injury does not include an additional obligation to make a specific positive use of it which, although intended to benefit the public at large, involves a loss to the individual himself.

13. "If the public is interested in any use of timberlands or of cut-over lands different from that which the enlightened self-interest of the owner may dictate, the public which is the beneficiary should pay the additional cost.

14. "The maintenance in idleness of cut-over land is declared to be wasteful. The larger truth would seem to be that it is wasteful to maintain cut-over land in such state of idleness as does not furnish safeguard against fire and ravage which destroys the natural reproduction of desirable species."

7. With the harvest of virgin stands stumpage prices (and the cost of the wood products) increase until they attain the cost of producing timber under forest management. Even after all the timber of a nation is being grown as a crop prices of material of the same quality tend to increase with the intensity of civilization.

8. In great land states (such as many of the United States) the business of forestry with its related industries will, next to agriculture, be the chief source of prosperity. The value of forest land generally decreases after forest destruction and increases according to the amount of net revenue earned by forest production, subject to the development of the use of land for other purposes.

9. As a new country with vast timber resources develops industrially the per capita consumption may show a decline as a result of the use of other materials for construction; there is, however, a certain limit beyond which consumption can not fall without serious economic handicaps. The tendency of modern commercial progress is to create new uses for woods which overbalance substitution and other factors checking consumption. Similarly, with more intensive settlement forests for recreation uses become more and more essential to national efficiency and wealth.

10. The milder the climate (in the temperate zone) the more rapid is forest production, and consequently the shorter is the time required to grow crops on soils of similar capacity. Therefore, large areas in the United States are admirably adapted to forest production.

11. No nation has learned and taken to heart the benefits of forestry without first experiencing disaster from economic shortage, floods, erosion, over-grazing, and other adverse results of forest devastation.

The conclusion is inevitable that the public is the ideal long-term forest owner because it can take a part of its profits in indirect benefits; therefore, a very much larger proportion

of the forests of the United States should be owned and managed by the Federal, State and local governments. Where the private forest owner uses his property so as to damage the interests of others, he must be restrained by wise laws, properly administered and enforced, but the success of mandatory forestry on private lands held solely for direct profits is very doubtful, unless there is State co-operation.

To solve the *forestry-timber problem* the timber owner, the forester and the public must get together and co-operate. Each must make some concession to reach the common goal—a lasting and adequate timber supply and the maintenance of forests for their direct and indirect benefits to the nation. Furthermore, I should want to see the lumbermen and timber owners intimately connected with our National Forest administration, some of them perhaps serving on a National Forest Advisory Committee if the Forester thought such a committee a feasible scheme. But one of the unsolved problems in connection with a termination of forest destruction is: “Who will pay for it? Shall it be passed to the consumer?” After all is settled, as it must be within a few years, the public will probably have to foot a large part of the bills by paying more for lumber, but the Government and the individual owner must do their part.

THE NEED FOR UNDERSTANDING

BY WILSON COMPTON

The anonymous article by Mr. X. in the December issue of the *JOURNAL OF FORESTRY*, entitled "An Answer to Dr. Compton's Fourteen Points," gives, I think, ample evidence that the author of the so-called "points" has not stated them with sufficient detail and precision. At least he has apparently not so stated them as to have given to his critic a correct understanding of his views on some of the economic aspects of a national forest policy. For such statements therein as may be subject to exception or criticism I am myself responsible since the article to which Mr. X. refers was—as is this brief response also—an expression wholly of my personal views. I think I have been in error on certain statements of facts and that Mr. X.'s criticism is well taken. But the exact truth concerning many of the points involved is so deeply imbedded in the haze of uncertainty and guesswork that at best there will be differences of judgment until the truth itself is known and fact shall have replaced opinion.

I find myself so cordially in agreement with Mr. X. on so many points, and in disagreement with him on so few, that I venture to suggest that his article might perhaps have been more appropriately called an "Elaboration" than an "Answer." I am under obligation to Mr. X. for his careful analysis and for his quite exhaustive citation of arguments, both for and against, the general statements of fact referred to as "points." These arguments I would myself have stated in detail had adequate space been available or had I felt that the absence of such fuller argument would have subjected the "points" to such misconstruction as Mr. X. has placed upon them.

Nor had I thought that the now all too general disposition to "spar" with imaginary opponents, rather than to understand actually opposing views, would lead to such misconstruction of the writer's purpose in restating views on national economic policy which he has held consistently for ten years, first as a college professor of economics, later as economist of the Federal Trade Commission; and to which he, as Manager of the National Lumber Manufacturers' Association, still adheres. If Mr. X. had been familiar with the economic literature relating to national forest policy during this period he might perhaps

have been able to interpret the "points" in the light of the writer's own previously published statements rather than, as he has done, in the light of his own "assumptions"—assumptions which he would then have known do by no means represent the writer's views or the views of the lumbermen generally for whom he is thought to have spoken.

Mr. X.'s article is, it seems to me, essentially a confirmation of the correctness of the general statements of fact, or the so-called "points," which he criticises. The acknowledgment of this as quoted from Mr. X. in the following statement, is all that the writer has contended for—namely, their validity as general principles:

"Taken by themselves, his (Mr. Compton's) 'principles' are so general that few will controvert them."

Under the varying conditions cited by Mr. X. in his article, I would in most cases have applied these general principles just as he has done and I would have reached quite the same conclusions as he has reached. What I have stated negatively as *cautions* Mr. X. has stated as positive *corollaries*. I believe just as strongly, with but few exceptions, in the specific conclusions which Mr. X. has reached (assuming the facts and conditions to be as he has stated them) as I do in the general principles themselves, since his specific conclusions are but concrete applications, under a given set of facts, of these principles themselves.

No well-informed person will fail to recognize the existence of the general conditions which Mr. X. has described. One might perhaps be led, however, at a few points to a different conclusion than that which he has reached. As I stated in the article in which the so-called "points" were outlined:

"The following statements of principles must obviously be brief. I am confident, however, that I may rely upon the high-mindedness of the reader *to interpret them in the light of reason and in the light of facts which he knows to be matters of common knowledge*. Thus may they contribute to clear thinking and straight thinking on national economic policy."

Assuming that I meant what I said, which I did, but which Mr. X. assumes that I didn't, his views are apparently not inconsistent with my own, except on one significant point. That is the *efficacy of mandatory private enterprise* as a way to the solution of our forest problem. The distinctive characteristic of *mandatory private enterprise* is, of course, that such enterprise would not be undertaken unless it were compulsory.

The question concerning *mandatory* enterprise, in forestry or in any other activity, is, I think, fundamentally one of its *efficacy*, rather than of its *legality* or its *morality*, or its *constitutionality*. With respect to the Constitution, I am free to admit the correctness of my critic's inference that I have some regard for that instrument. But I doubt whether constitutionality, in the matter in issue, is either in question or in point. Economically the sole issue is: Will *mandatory private enterprise* solve our problem, or help to solve it?

This is perhaps the key to the opposing viewpoints which discussion of this subject has revealed. As Mr. X. has pointed out, I think correctly: Private forestry under any given conditions is either profitable or not profitable. To quote his statement:

"An individual farmer or an individual timber owner, of course is under no public obligation to remain permanently in the business of growing timber or crops if it is against his personal interest. * * * As classes, however, farmers as well as timberland owners are under public obligation to continue producing crops. * * * If in individual cases timber can be grown on the land only at a financial loss, one of two things must be true; either the land can be put to some other use which does not involve a loss, and should therefore not be considered potential forest land, or it cannot be owned by the individual except at a loss, in which case it is difficult to see why the owner should want to keep it."

I cannot escape the conviction that if private enterprise will not solve our problem, when private enterprise is *not* mandatory, it will not solve it if private enterprise is made *compulsory*. This is true no more and no less of forestry than it is of any other kind of business enterprise.

If private enterprise in forestry is profitable, and to the extent to which it is so, it will seek and should have access to the field. To the extent to which it is not profitable, the effort to compel it by making it mandatory is futile. It is chasing the mirage!

The necessary and universal result of such policy would be a change in the ownership of the lands upon which forestry by private enterprise would thus be compulsory but could not be profitably practiced. Public ownership would simply succeed private ownership. But we would still have our same old problem. A mere change in land ownership will not solve the timber problem. It will not *put* trees where trees were not before. Forests are not made by legislation.

A forest policy, as a matter of legislation, might, it is true, be adopted that would make timber culture on private lands compulsory. But

such a policy it seems to me, insofar as it involved private enterprise, irrespective of its profitableness, would result in the long run not in the production of trees but in a change in land ownership. A forest policy that does not produce forests is to my mind not a forest policy.

Private enterprise of course should, and with encouragement and education, will, so far as it can, permanently maintain forests on appropriate lands. But enlightened self-interest—enlightened because of its consideration of public welfare—and education of land-owners to the possibilities of profitable enterprise in reforestation, are the influences that lead men into such enterprises. If these influences will not suffice, legislation cannot do it by compulsion. Nations like individuals cannot by law make something out of nothing.

The fundamental criticism of a public policy of mandatory private forest enterprise, is, it seems to me, not on the grounds which Mr. X. has assumed, but rather because it is "chasing the rainbow"; because it will not solve our problem. Private enterprise should logically go as far as it can in meeting the need of the future. But if private enterprise, enlightened and well-informed (as it can be made to be), does not fully meet the public need, the obligation is upon the public, through its own chosen and orderly agencies, to do what private enterprise is incapable of accomplishing.

This is no novel principle. It applies no more to the practice of forestry than to any other necessary economic activity. It has its expression daily in many of the now ordinary activities of our Government, both State and National. It is not a question of opinion but a question of fact.

Like every other owner of property the owner of forest land is bound in law so to use his property as to do no harm to the property of another, and to do no public injury. This obligation is universal, is everywhere recognized, and should be enforced. If so enforced, through the medium of more adequate arrangements for the protection of forests and forest lands, forest replacement by natural processes would have a better chance—and that it should have no one may doubt.

There is successful precedent and ample authority for making promptly effective a plan of forest protection and natural replacement. It seems to me that there is wisdom and promise of success in a program of this sort, which may be intelligently formulated upon the basis of known fact and of actual experience. It is difficult for one to have confidence, however, in the success of any plan which violates economic

principle or ignores universal facts drawn out of generations of human experience.

In the end the facts will prevail. They always do. Surely the only purpose in this matter, of those truly interested in constructive and permanent accomplishment, is to ascertain correctly and fully the facts as they are; to interpret these facts accurately; and wisely to translate into positive action the sound principles thus determined. If we might perhaps omit our "sparring" with imaginary opponents and make perhaps a more earnest effort to understand actually opposing views, the agencies, already in existence, of the Public, of the Profession of Forestry and of the Forest Industries, might then together, in this matter of common interest, more effectually promote a wise and lasting accomplishment.

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REPORT OF SUBCOMMITTEE ON FOREST LEASING, FOREST LOANS, AND FOREST INSURANCE

PROFESSOR R. S. BRYANT, *President,*
Society of American Foresters,
New Haven, Connecticut.

DEAR SIR:

Herewith is presented the report of the subcommittee appointed by President Olmsted to consider the subjects of forest leases, forest loans, and forest insurance.

While the committee has had some discussion of the report, it has not come to entire agreement on all of the details, and the different parts should be considered as the ideas of the individuals who prepared them, rather than as the unanimous opinion of the committee as a whole. The section dealing with leases was prepared by Professor Bruce, that on loans by Professor Kirkland, and that on insurance by Mr. Sparhawk.

It is suggested that in order to secure full discussion of these subjects the report be published in the JOURNAL OF FORESTRY.

Sincerely yours,

WILLIAM N. SPARHAWK,
DONALD BRUCE,
BURT P. KIRKLAND,
Committee.

FOREST LEASING

The Purpose of Forest Leasing

The leasing of forest land by the National Government has been advocated as a means to three distinct and separable ends: (1) The encouragement of forestry by example and by overcoming private inertia in initiating forest management; (2) the removal from the lumber industry of the economic pressure of its overload of stumpage and hence permitting it to handle better its forestry problem; (3) to take the place of outright purchase and yet avoid the heavy initial expenditures involved therein. These objects are so diverse that a different plan of leasing would have to be adopted for each. It seems, therefore, that a preliminary decision must be reached on which, if any, of these ends is desirable, before considering the detailed plan necessary to attain them.

Encouragement of Forestry

The general lines of this proposal are that the nation should purchase potential forest land and reforest it, with the intention of returning it to its former owner as soon as the new stand is past the difficult stage, this return to be at the actual cost to the nation, plus interest, of the work done. The owner is then supposed to be sufficiently encouraged and interested to carry on the work, with the resulting establishment of a private forest industry.

There is no assurance of these results. On the contrary the plan would undoubtedly result in a heavy financial loss to the Government without the certainty of the establishment of private forestry as a return. In a large program of reforestation, certain tracts would prove profitable and others failures. In the scheme contemplated, it would be almost certain that all the most profitable areas would be bought back by their owners at cost, leaving the nation to stand the burden of the remainder. Once in the hands of the private owner, it would be difficult to assure the continuance of forestry on private tracts. It would be easier and safer for him to realize on the benefits already accrued, and then to permit the nation once more, if it would, to run the risk of a second rotation.

This plan has been tried by certain Eastern States but without any phenomenal success. It is not felt that it merits more extensive application at the present time.

Holding Virgin Timber

Many of the evils connected with the lumber industry as now organized have been ascribed to the overload of standing timber on which the carrying charges must be paid and which thus force the cutting of timber more or less regardless of market demand. It has been proposed, therefore, that the nation lease large areas of virgin forest land and hold them until they be needed by the consuming public. They would then be returned to their owners for operation in the usual way. The price would of course have to be the cost to the Government of holding the land during the intervening period; that is, the rental plus carrying charges plus compound interest. It should be noted that this plan does not result in any increased production. It attacks the economic not the silvicultural side of the problem and it is hard to see that any great benefits to the public would result. As a matter of fact

the lumber industry has suffered but little from actual over-production although greatly from potential over-production. There have been cases where timber has been cut and wasted, but these instances are isolated. The major portion of so-called waste is the direct consequence of low-priced stumpage. It is an evil which cannot be alleviated except by increasing the cost of lumber to the consumer but which will almost automatically right itself with the inevitable future rise in prices. This rise might perhaps be slightly less under governmental control and this is the chief gain which could be expected for the public under the plan. If the Government can obtain money at say 4 per cent while the industry has to pay 6 per cent or 7 per cent, the cost of stumpage in 50 years will obviously be less if in Government hands. But the selling price may well prove to be less than the cost even at 4 per cent interest. It is conceivable and perhaps even probable that supply and demand aided by competition of second-growth timber and perhaps of imports and surely of substitutes will fix a future price which would result in a loss for even the Government.

It seems clear that the plan is immensely desirable for at least a certain class of private owners. It would enable them to realize at once on large speculative profits that they have already made (on paper) through timber holding and would relieve them of the risk of future loss. But it is not clear that the gains to the nation would offset the expense. Since this plan does not touch the silvicultural essential of increased production, its adoption is not favored.

Substitute for Purchase

It is coming to be more and more accepted in the United States as well as in Europe, by lumbermen as well as foresters, that the growing of saw timber is, on account of the long rotation involved, largely a governmental function. One of the difficulties involved in a plan for increasing the amount of forest land under Government ownership upon any adequate scale is the heavy initial investment. This is particularly serious at the present time on account of the strain on the nation's credit due to the floating of a series of war bonds. A system of leasing can be devised which will be virtually equivalent to purchase but with the financial burden distributed over long periods of years. This is the object favored by this report. The details recommended follow:

Rental.

The rental should be equivalent to interest at the market yield of Government bonds on the appraised value of the land plus the reproduction and merchantable timber (if any) growing thereon. A liberal appraisal of the reproduction and a close appraisal of the land will have a desirable effect in putting a premium on better logging methods from a silvicultural standpoint by private owners.

Addition for Sinking Fund

For very long-term leases it will be found that a trifling addition to the rental will build up a sinking fund sufficient to purchase the land outright at the end of the period. Assuming the cut-over land worth \$6 per acre of which the bare land is valued at \$3, and the reproduction at \$3, and interest at 4 per cent, the actual rental would be 24 cents. The annual payment on the sinking fund to equal \$6 at the end of 100 years is only about 4.8 mills. It is obviously advantageous to pay in such a case a rental of 24.48 cents and thereby acquire free title after 100 years instead of paying 24 cents through eternity. This sinking fund payment should be handled as part of the rental and paid to the owner annually. The lease plan is thereby modified into an installment plan purchase.

Period of Lease

The period of the lease should be the approximate rotation for each tract. On account of the sinking fund provision, mistakes in fixing this period accurately would be of little moment.

Taxes

It has been generally accepted that in the case of public purchase some provision would have to be made to reimburse the States and counties for the withdrawal from their tax lists of large values. This same policy should apply to leasing. The simplest procedure would probably be for the owner to deed his land to the Government under a contract which provided for proper annual payments, thereby leaving the reimbursement in lieu of taxes to be dealt with between national and State and county governments.

Right of Owners to Repurchase.

The provision that the owner can at his option terminate the lease and regain control of his land upon certain payments is not advocated

Were this payment to be the cost value to the Government of the holding of the land to date, it would result in the alienation of all profitable projects as soon as the timber was ripe for cutting, leaving the unprofitable land in the hands of the Government. Were the payment to be market value or expectation value (in the case of young timber) there would be no reason for the owner to exercise his option except in the case of a faulty valuation. Any plan would leave the Government's silviculture and management alike at the mercy of such unpredictable influences as a further shrinkage of the value of the dollar. No benefits can be seen sufficient to offset these possibilities.

Character of Land to be Leased

In general only such land should be leased as will further the ends of the plan; that is, the increase of timber production. This means practically the restriction of leasing to cut-over lands on which the new crop has not yet passed through the critical, juvenile stage. On account of the vast areas available as compared to the probable magnitude of any plan which may be adopted, tracts necessitating extensive and doubtful reforestation should be avoided. Land of high value for agriculture should also be avoided. Great freedom, however, should be left the administration as exceptions to these principles probably will be desirable in blocking out proper units for management.

National vs. State Acquisition

There is no reason why the plan herein recommended should not be adopted both by the nation and by individual States as well. As only a few States are as yet in a position for immediate action along such lines, it is recommended, however, that the national program be organized without regard to possible State competition. If this develops, later on, a co-operative adjustment through the adoption of national and State purchase zones should offer no difficulties.

Administration

The administration of the plan should be in the hands of the U. S. Forest Service.

Rate of Acquisition

There is probably in the neighborhood of 2,000,000 acres of land unsuited for agriculture cut over each year. There are also many

millions of acres of land cut over in the past. The present area of the National Forests is about 150,000,000 acres, of which perhaps 100,000,000 are productive timber land. In Europe it has been found that the line between the timber importing and timber exporting countries lies at the point where there is nine-tenths acre per capita of forest land. A new country, such as ours, needs more and we can expect our population to double within a short term of years. It therefore appears a minimum program to acquire for the Government the equivalent of the newly cut-over land of each year, or about 2,000,000 acres. This would bring the land under national control at the end of the first century to about 300,000,000 productive acres. The annual expense of such a plan will depend on many uncertain factors but is estimated at about \$500,000 for the first year. Each subsequent year would see the amount increased by a similar figure until the leasing program ceased. It would then continue constant until the end of the rotation period when it would decrease by the same annual differences to zero. At the end of the rotation period returns may be expected to commence from the ripening timber which will not only pay all future expenses but yield a good return on the investment of the past.

FOREST LOANS

Fundamentals of a Forest Loan Policy

Finance plays a dominant role in the direction of industry and tends toward more and more control of industrial policy. Our railroads, our public utilities, our steel industry all conform to the mandates of the financier. This situation is seemingly unavoidable but brings in some respects unsatisfactory results. Under it the test of all industrial policy is "will it give immediate profit?" Still worse, some of the nation's store of wealth is used as real "predatory" wealth functioning like the highwayman along the channels and highways of trade, or exacting tribute for the use of some privately owned natural resource without giving service in return. Also the determination of industrial policy solely by the financier frequently means determination by one unfamiliar with the technical details and special needs of the industry. To meet these objections two things are necessary: First, that specialized financial institutions be created to deal with each industry. This makes possible that the technical details of the industry will be understood by the financial expert dealing exclusively with one instead of

many industries. Second, that there be some measure of public control of the specialized financial institution in order that the idea of service to the public by the industry may have adequate consideration. Wise public intervention also creates confidence on the part of the investor and thus assists in moving the securities issued at a reasonable rate of interest. Since the chief function of such institutions is to loan capital to the individual units of the industry and use the credit instruments received in return for such loans as collateral for large bond issues to be sold in the money markets of the world, and since the large size of such issues (which makes them well known) assists in marketability, it is plain that Federal agencies have a better chance of success. Few better means of freeing industries of monopolistic control can be devised since under this plan of public intervention a situation such as is known to exist in waterpower development where certain agencies are able to prevent the financing of competing plants can scarcely arise. (Legitimate restriction of plant development to the needs of any locality is right and proper, but prevention of needed plant construction is not.) Industries, such as the steel industry, which are organized in large units easily get capital under favorable terms so that central organization of their credits with assistance of the Federal Government is not so necessary from the standpoint of economy, though it may be from the standpoint of freeing that industry from monopoly and allowing the small concern to exist on equal terms with the larger.

Industries organized entirely in small units, as is agriculture, cannot get capital on cheap terms, hence this has led already to the successful organization of the Federal Farm Loan Board, which may be considered the best existing example of a specialized financial institution serving one industry. Other precedents of closely similar kind were created during the war, while the Edge bill permitting creation under the Federal Reserve Board of organizations for financing foreign trade is a recent similar example.

Although the funds advanced to the Federal Farm Loan Board by the Federal Government are rapidly being returned, farmers are getting capital at a less rate of interest than the lumber industry, not because they are being subsidized by the Federal Government, but through the power of effective organization of farm credits.

As in the case of the farms, forest industry is and will continue to be for the most part organized in small units unless monopoly is allowed

to be built up through neglect to assist efficient small producers. The writer believes, therefore, that the forest industry should have the advantage of Federal assistance in organization of credits in order that cheaper capital may thus be made available to assist both in forest production and in more efficient utilization of existing forest resources.

A discussion of this subject having been undertaken by the writer previously,¹ he will confine himself in this subcommittee report to the following summary of the situation which is submitted as a basis for future discussion:

A. Necessity for Better Organization of Forest Credit

The better organization of the credit of forest industry is necessary for the following reasons:

1. Forestry cannot be carried on by private owners who must operate on borrowed capital if the interest rates on borrowed capital exceed the interest rate which forestry will earn.

2. It is generally conceded by authorities on the subject that forestry will not make a *current return* of more than 3 to 6 per cent on the investment.² (See footnote A.)

3. The present rates paid on forest loans are in excess of the above rates of forest earnings, being $6\frac{1}{4}$ to 7 per cent.³

4. It may be concluded that the rates on capital borrowed under the existing organization of forest industry credit are a grave handicap to the practice of forestry on private lands, and also tend to force premature cutting where continued forest production may be inadvisable.

¹ See JOURNAL OF FORESTRY, Vol. XVII, No. 3, March, 1919.

² See Roth, "Forest Valuation," page 26 and following.

³ Report No. 114, U. S. Dept. Agriculture, pp. 14-15, "Some Public and Economic Aspects of the Lumber Industry," by W. B. Greeley.

FOOTNOTE A. Organized annual sustained yield forestry by maintaining a large growing stock (amounting to half what grows in any one rotation period for the tract under management) which is constantly increasing in price makes possible an additional return due to constant increase in value of stumpage. This second return has in the past formed the main reason for timber investment, but under past exploitation policy the continuance of this return is cut off at the same time the possibility of *current annual returns* is cut off by wrecking the forest.

This return from "unearned increment" may amount to from 2 to 8 per cent in addition to the current return, but as it is realized only by a sale of the property or increased capitalization due to gradually increasing earnings, it is not currently available for meeting annual interest charges.

B. Possibilities for Cheaper Capital.

The following facts justify the expectation that cheaper capital may be available to forest industry under certain conditions:

(1) Cheaper loan capital is available to those industries whose assets are in no danger of shrinking to less than the face value of the loan secured by these assets, whose assets are marketable, and whose credit is well organized. The steel and railroad industries are examples.

(2) Forest industry holds not less than six to seven billion dollars of assets in the form of standing timber, constantly increasing in value, together with mills and logging plants. If loans were placed against the various units of the industry to the amount of 50 per cent of these assets, there is no probability of such shrinkage of their value as to jeopardize the security. Forest industry, indeed, possesses a vast volume of the most stable assets.

(3) The high interest rates paid by the industry can therefore be accounted for only on the ground of unorganized small borrowing, which can not draw on the money markets of the world on equal terms with those industries which are financed on a wholesale scale.

C. Organizing Credit of Forest Industry to Secure Cheaper Capital.

1. The average individual borrower in forest industry, on account of his small borrowings, cannot expect to secure cheap capital. Organization of borrowers is therefore necessary.

2. The Federal Farm Loan Board forms a guide to the kind of organization advisable. A Federal Forest Loan Board should be authorized, which will act along similar lines. It should loan its capital to existing individual and corporate owners of forests and forest industries, taking first mortgages with adequate margin of safety, as security therefor. These mortgages should then be used as collateral security for large bond issues which will be salable in the money markets of the world.

3. Attention is specifically called to the fact that the function of the Federal Government as here contemplated is to assist in organization of a worthy activity, something which might be expected by any industry. Any funds which it may advance to the Forest Loan Board will be in the nature of a loan, so that the aid here contemplated to be given by the Federal Government does not constitute a subsidy to the industry. Since the consumer should expect to pay such a price for forest products as will make their production profitable, a subsidy is wholly unnecessary and inadvisable.

FOREST INSURANCE

Why Forest Insurance Is Needed

The statement is often made that one of the greatest obstacles in the way of the practice of forestry by private owners is the time element—the long period required to grow crops of timber. This is not exactly true, as is shown by the fact that, other things being equal, conservative investors are willing to accept a lower rate of return on long-time Government bonds than on short-term notes. It is true that the bonds yield a return annually, but so does a forest properly managed on a conservative basis, as has long been demonstrated by the regulated forests of other countries. The difficulty is not due primarily to the time element, but to the element of risk involved—the uncertainty that young forests once started will ever go through to maturity so that returns can be realized. It is bad enough to run the risk of destruction by fire, hurricane, blight, or insect infestation for one year, but when the same crop is subjected to the cumulative hazard from these sources for 50 or 100 years or even longer, the investment loses much of its attractiveness for a private individual.

That this risk has generally been very much overestimated is true, yet it is largely, though of course not entirely, due to fear of these hazards that forest owners in many regions are anxious to convert their timber into cash as soon as possible, that they hesitate to invest money in leaving merchantable material for a second cut or in starting and protecting new stands, and that they have to pay unduly high rates for money borrowed on standing timber. The uncertainty whether a young stand will ever be harvested is responsible for the general lack of a recognized value for stands of reproduction or very young timber, so that they are practically worthless for purposes of sale or as collateral for loans.

Strict and conscientiously enforced forest fire laws, backed by intelligent public sentiment, and coupled with efficient and thorough protective organizations, will go a long way toward reducing the hazard. With the best of protective systems, however, there will still be losses, just as there are still fires even in the cities with the most up-to-date fire regulations and the most efficient fire departments.

Fire protection alone will not suffice to reduce the business of forestry to a basis attractive to conservative investors. It is necessary not only to protect the forest owner against damage by fire or other agencies,

but also to secure him against loss in case damage should occur. Any plan which will accomplish this—which, in other words, will insure that he or his successors will be able to raise the timber to maturity or to receive its actual cash value if destroyed by any cause before it can be harvested—will afford a tremendous incentive to the timberland owner to maintain his land in productive condition.

Status of Forest Insurance in the United States

Forest insurance has been developing for a number of years in several European countries, but was not undertaken in the United States, excepting possibly a few scattering instances, until about 1916, when an old line fire insurance company began to write policies on standing merchantable timber in the Pacific Northwest. This insurance was limited to a comparatively small region, applied only to mature timber, and covered only accessible timber which could be salvaged in case of damage. Early in 1917 a few New Hampshire timber owners formed and incorporated the New Hampshire Timberlands Mutual Fire Insurance Company, for the purpose of insuring merchantable timber and young growth. This company wrote insurance at a fairly reasonable rate with a considerable degree of success, and demonstrated that forest fire insurance is practicable in the United States. It was, however, confined to a rather limited region, was organized on a very conservative basis as to the risks which would be carried, and was unable to expand as rapidly as was desirable because of various limitations and requirements in the insurance laws of different States. Its business has recently been taken over by a commercial insurance company with wide connections and large resources, which enable it to do business on a larger scale and at lower premium rates than those charged by the original company.

Forest Insurance a Distinct Business

While it is probably true that the business of insuring forests may be taken up on a gradually expanding scale by old line companies, it is nevertheless evident that forest insurance presents peculiar problems not common to other forms of insurance. To be carried on efficiently, at costs which shall be at the same time fair and as low as possible, it should be handled on a country-wide basis. To accomplish the purpose intended, namely, the protection of growing forests and the stimulation toward proper use of forest soils, forest insurance must

be sufficiently liberal in its scope to cover all forests, no matter how large or how situated with respect to markets. It should also eventually cover other forms of hazard, although fire insurance should first be taken up, and other forms of insurance can be added later on. It appears extremely desirable, then, that forest insurance become established as a distinct business, organized on a very large and a very liberal basis, rather than a subsidiary department of a regular fire insurance business.

Reasons for Slow Development of Forest Insurance

That a general system of forest insurance against fire, at least, has not been in effect long ago in the United States is due probably to two principal causes: First, there has been no definite knowledge as to the hazard involved, but rather a grossly exaggerated idea of the costs of such insurance. Much has been said and written about the enormous total annual forest fire loss, but the distribution of this loss and its relation to the total values involved are not so well understood. Old line companies which have written a few policies on timber have charged premiums of from $2\frac{1}{2}$ to 5 per cent per annum—rates which are of course entirely too high for a forest owner to carry, and are out of all reason considering the hazard. Even less is known about hazards from other causes than fire. Second, reasonable standards of protection against fire or other harmful agents have neither been generally enforced by law nor adopted voluntarily by owners, except in a few rather limited regions, and there only comparatively recently.

Action Necessary to Make Forest Insurance Practicable

To make a nation-wide program of forest fire insurance practicable, action along these lines is necessary:

1. Steps should be taken to insure complete and accurate reports of all forest fire losses in all parts of the United States. These reports should be uniform in character, and should give all the information needed for classifying and rating risks. It will also be necessary to have fairly accurate classified estimates of the total forest values subject to risk. The Federal and many State Governments and several private protective associations already do obtain reports on fires occurring within their respective jurisdictions, but these reports are by no means uniform in the information called for, are far from complete, and in many instances very inaccurate, especially in estimates of the amount of damage done.

2. A central actuarial bureau should be established, to receive all fire reports, correlate and compile them, and to work out standard classifications of risks and maintain up-to-date standard ratings for the various risk classes. The fire records collected by various agencies during the past few years, even though incomplete, offer a basis on which to start. This bureau should be analogous to the Actuarial Bureau of the National Board of Fire Underwriters, which works out classifications and ratings for other forms of fire insurance. It should be established by concerted action of the various interested agencies, including associations of timber owners, associations of farmers, State forestry departments, and the Federal Government, in which case all parties would share the costs, or it should be established and supported by the Federal Government.

3. In order to establish conditions which will make nation-wide forest insurance practicable at low rates, the individual States should enact and enforce effective laws against forest fires, including the requirement of at least certain minimum standards of fire protection, such as disposal of slash where necessary, elimination of other hazards, regulation of the use of fire which might endanger forests, and establishment of organizations for fire detection and suppression. The cost of such measures may fairly be divided between the private owners and the public, including the National Government as well as that of the individual State, since the maintenance of forests in productive condition is of great national concern. It is easy to see that with the insurance organization successfully functioning, and with due allowance for protection standards when fixing premium rates as between different localities or States, the desirability of maintaining efficient standards will be evident to all forest owners concerned.

By Whom Should Forest Insurance Be Carried On?

The question then arises as to the organization of the insuring body itself. Should it be handled by private corporations working for profit, by mutual inter-insurance societies of forest owners operating at cost, or by some public agency? Several points should be considered in this connection. In the first place, a successful forest insurance organization must for the sake of safety cover a very large territory, in order that the risks may be distributed over a wide variety of forest and climatic conditions. Only in this way will it be possible to avoid the danger of bankruptcy because of great conflagration. One State, or

even a group of States in one general forest region, makes too small a unit. In the second place, to be effective, it must be possible to insure the full value of any forest property involved, no matter how large it may be. No private organization could do this at the start, or until it had grown to a very large size. Third, it seems extremely desirable that the agency which insures the property should work in very close co-ordination with that which protects it against fire, since effective control of the fire protective organization will have a very decided influence on the cost of insurance. Fourth, it is essential that in a business like forestry, which in many cases may operate on a rather narrow margin of profit, all costs, including insurance, be kept at the lowest possible figures. Forest owners can hardly afford to pay to a private insurance company a profit above the cost of doing business, and in some cases they may even need for a time assistance from the public in carrying the actual cost of insurance. Fifth, any private forest fire insurance organization would necessarily be subject to rather close public regulation as to rates and conduct of its business, just as is the case with other insurance companies today.

Taking all these things into consideration, it appears that the advantages inherent in a system of forest insurance under public auspices, national rather than by States, will far outweigh any possible disadvantages. An organization sponsored by the Federal Government would be nation-wide in scope; it could write insurance on the largest private holding without danger of bankruptcy; it could exercise very close co-operation and, if need be, control over the agencies engaged in fire protection. As the object of forest insurance is not to afford an easy way of converting forests into cash, by burning them up, but is rather to perpetuate our forest resources, it would be entirely proper to require that in case of destruction, so much of the indemnity as might be necessary should be used to restock the burned-over area. This could be required by a Government insurance company, which might do the reforestation itself, where it probably could not be required by a private company.

Finally, the public, regardless of State lines, has a very urgent interest in the perpetuation of our forest resources—more than in the perpetuation of most other forms of property, because forests, once destroyed, can only be replaced after many years. Moreover, many public interests in the forests, such as influence on climate, stream flow, recreational advantages, and the like, cannot be assigned to the

individual owner, nor should he be expected to bear the entire cost of maintaining them. It is quite possible that because of the benefits accruing to it from the existence of great forest resources, the public should bear part of the cost not only of protecting such property from destruction, but even of insuring the owner against loss in case of such destruction. This is especially true in case of regions where the conflagration risk is great, or of forests where the fire risk is due largely to the general public (campers, railroads, etc.) or of forests at present inaccessible, but which nevertheless have a great potential value for future generations. Under a system of government insurance, the public could very readily contribute its proper share of the costs.

Recommendations

The following action is recommended:

1. The adoption in all States of effective forest fire laws, requiring definite standards of fire protection, and complete reports of all fire losses.

2. Establishment of an Actuarial Bureau at Washington, either in the Forest Service or in close connection with it, to collect reports on forest fire losses and to make standard classifications of risks and work out rates of insurance therefor. Such Bureau should have the power to require complete and uniform fire reports from all parts of the United States.

3. As soon as the Actuarial Bureau has worked out preliminary classifications and hazard ratings for forest risks, which ought to be possible within one or at the most, two years, it should be expanded into a Federal forest fire insurance organization. The costs of operation, as well as of extraordinary losses, such as conflagration losses, should be borne by the public, and private owners should pay not more than the actual ordinary loss costs of insurance. All public forests belonging to States or minor political divisions should be insurable under this plan, and all private forests whose owners desire it and which, through their owner or through the States in which they lie, are afforded protection at least equal to minimum required standards.

Whether such an organization should be connected with the Forest Service, with the Treasury Department, or with some other branch of the Government, is not clear at this time. This and other details which it does not seem proper to go into in this report should be worked out by a committee representing the Federal Government, the States, the forestry profession, and private timber owners, including both owners of large tracts and farmers.

THE RELATION OF RESEARCH IN FOREST PRODUCTS TO FOREST ADMINISTRATION

BY OVID M. BUTLER

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The aim of research in forest products is to determine the properties of wood and with that knowledge, to promote through experiments or otherwise the best utilization of forests and forest lands by the industries and by the public. In the minds of many this research stands in relation to forestry and that phase of forestry embracing work in the woods as the nether pole. They continue to think of forest production and forest utilization as two independent efforts, mutually sufficient in themselves, and it is difficult to close that gap in the general conception of forest administration.

The forester in the woods marking timber, making growth determinations or appraising stumpage is usually far removed from the competitive markets in which his product is absorbed and from which his stumpage in large measure derives its commercial value. This will be increasingly true in the future owing to the growing distance between forest supply and lumber market. For this reason, even foresters are quite naturally apt to underestimate the direct bearing on their own practice of current and potential developments in the utilization end of the industry.

Research in forest products leads to specialization in the different properties of wood and opens the way to utilization on the basis of the relative values of these properties for different products and different purposes. This specialization in wood properties and wood utilization has not developed as rapidly as specialization in many other industrial fields. Nevertheless it has made sufficient progress, especially in recent years, to indicate quite clearly that our increasing fund of scientific knowledge relative to the chemical, physical and mechanical properties of wood is sooner or later going to exert a tremendous influence upon market and forest utilization, upon stumpage and lumber values, and both directly and indirectly upon forest practice. This whole movement, in fact, is so intimately related to forest production that neither research in forest products nor the practice of forestry in the field can

reach their maximum effectiveness without the closest co-ordination of thought and effort.

Species, the wood structure of which make them especially desirable for a given product of value, for example, whether that product be lumber for airplane parts or lead pencils, news print paper, or ethyl alcohol, will naturally be valued on that special property to the extent to which it is commercially profitable in relation to some other form of utilization. It is on that basis that timber prices, under normal conditions, will more and more be sifted down by supply and demand. This fund of information with respect to the properties of wood will enable foresters more intelligibly to direct forest utilization and forest production, not necessarily for highest returns financially, but for greatest benefits from the standpoint of our broad national requirements of forest supplies.

Within a little more than half a century our forest utilization has advanced from the production of rough boards and planks, crudely manufactured, to a versatile list of products including lumber of innumerable patterns, designs and finishes, veneers, plywood, paper, naval stores, fibre boards, ethyl alcohol, tannic acid, fibre silk and a long list of minor products. Today research and industry are moving forward more strongly than ever before in the development of new uses of forest products and in the improvement of utilization practice. Every development and improvement in this field is of concern to the forester because of its possible influence on the practice of forestry broadly or upon forest industries within his locality. This influence works primarily through market values which, in turn, affects stumpage values and often alters forest industries and forest utilization broadly and locally. Unless, therefore, a forester is thoroughly familiar with market and utilization movements, both present and potential as reflected by research, he will be badly handicapped in rendering the most proficient forest administration.

Apart from its broad and basic bearing on forest administration, research in forest products is an inseparable part of field or silvicultural research and practice, and cannot be successfully separated from it. The study of the microscopic wood structure of longleaf pine in relation to resin flow, which showed how to conserve the living timber and raise the quality of the product obtained from it, would not have been successful and the practice of a whole industry would not have been altered, without the co-operative participation of foresters, chemists

and wood specialists in co-ordinating their work and in carrying the study into the woods. These combined or co-ordinated studies and experiments not only influenced naval stores practice but they put into the hands of the forester knowledge by which he may manage longleaf pine forests with more profit and less damage to the growing timber.

This interdependency of research in forest products and silviculture may be further expressed by considering our expanding fund of knowledge with respect to the mechanical properties of wood. On the surface this data does not appear of great concern to foresters engaged in forest administration or silvicultural research. They have long recognized, to be sure, that various species of wood possess special properties which have earned special values in the lumber market. These values have, in turn, reflected themselves in stumpage values by species, that is, the special properties have been recognized broadly as common to the species rather than to the character or quality of the wood. And, until quite recently, variability within the species has been given either minor consideration or no consideration at all. Oak has stood for strength, hickory for toughness, mahogany for pleasing effect, cedar for durability, ash for bending, and so on.

We have now, however, entered upon the era of selection for quality within the species, properly recognizing that the poorest of our common species may produce some material stronger than the weaker pieces of clear sound oak and tougher than some pieces of clear hickory. From several hundred thousand strength tests of 126 different species, research has definitely determined that there is a direct relation between the specific gravity or density of wood and its strength properties.¹ This relation holds approximately true regardless of species, the density of wood substance being so nearly constant that for any species density or specific gravity of the wood may be taken as a measure of the amount of wood substance contained in it.

With this fundamental information, it was possible to draft definite and reliable rules, not merely for determining the mechanical properties of wood in general, but for comparing various species and selecting the species and material within the species best suited for specific purposes. In place of trade names designed to indicate strength and quality, such as "longleaf" and "shortleaf" yellow pine, for example, which often had no reliable or technical basis or significance, it was

¹ "The Relation of the Shrinkage and Strength Properties of Wood to Its Specific Gravity," by J. A. Newlin and T. R. C. Wilson, July, 1919.

possible to substitute a definite and practical rule based on the actual inherent character of the wood structure. In the absence of such a rule, a more or less chaotic situation in the southern pine trade had developed. There was much misunderstanding among manufacturers and consumers because of the lack of a reliable method for determining whether yellow pine lumber of any particular class was adapted to the purpose intended, and the merchandizing of yellow pine and the efficient use of structural timber has suffered considerably.

The use of the terms "longleaf" and "shortleaf" to segregate quality classes was becoming more and more ineffective and confusing, and owing to the very wide and overlapping margins of quality characteristic of the southern pine species, structural timbers were getting into bad repute. Substitution of material lacking in strength and durability could not be eliminated and the quick failure of much southern pine structural material was throwing discredit and loss upon the entire yellow pine trade, and was demoralizing the market for structural timber in general.

The application of research data met this intensely practical situation and expressed itself in the specification including the density rule adopted by the Southern Pine Association and later by the American Society for Testing Materials. This specification reads as follows:

Southern Yellow Pine.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), Cuban pine (*Pinus heterophylla*) and pond pine (*Pinus serotina*).

Under this heading two classes of timber are designated: (a) dense Southern yellow pine and (b) sound Southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species.

(a) Dense Southern yellow pine shall show on either end an average of at least six annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth and fifth inches of a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast in color between summerwood and springwood shall be sharp and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 in. on an approximate radial line beginning at the edge nearest the pith in timbers over 3 in. in thickness and on the second inch (on the piece) nearest to the pith in timbers 3 in. or less in thickness.

In dimension material containing the pith but not a 5-in. radial line, which is less than 2 by 8 in. in section or less than 8 in. in width, that does not show over 16 sq. in. on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-in. radial line the inspection shall apply to the three inches farthest from the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller the average summerwood and number of rings shall be the average of the two radial lines chosen.

(b) Sound Southern yellow pine shall include pieces of Southern pine without any ring or summerwood requirement.

Within the past six months the West Coast Lumbermen's Association adopted a density provision for Douglas fir which is the same in principle, although there are some differences as to where measurements are to be made and as to the minimum size of timbers in which pith or "boxed heart" is permissible.

The foregoing rules are of direct concern to lumbermen and foresters, particularly the latter, in a number of different ways. More and more they are bound to exert a strong influence towards stability and permanency of market prices of structural timbers because they will assure clear cut grades and quality and will thus clarify competition and establish sound lumber values. The forester whose responsibility it is to appraise forests which contain structural timber will readily appreciate the vital relation between these values and market movements to his own work in the woods. Stumpage appraisals as conducted by the Forest Service, for example, hinge sharply upon the relative accuracy of the appraiser's estimate or calculation of the quality of the standing timber and its manufactured market value. Unless this be determined quite closely, a safe estimate of stumpage values of the stand cannot be arrived at. It is obvious, furthermore, that the success of forest administration and forestry itself is dependent upon sound, clearly defined and stable market values and that all factors which affect or determine the quality of the timber in the standing tree and which can be isolated for practical use, aid directly in the establishment of those values.

But without further information which must be obtained through studies in the forest the present forester cannot make full application of the density principle. In a standing forest density is a variable factor. One tree may contain timber of very high specific gravity, while an adjacent tree may show the opposite. No studies have been made to determine authoritatively the causes for these differences in

structure with their resulting differences in strength properties. No methods, therefore, are at hand for the appraiser to use in determining within reasonable limits the percentage of dense structural timber in a stand. It is possible that stump borings made upon sample areas or in connection with the timber survey would work out satisfactorily, but until the whole subject of growth in relation to density has been worked out by the silviculturist, the stumpage appraiser will be at a loss to know the best method of determining the quality of timber in a stand.

The relation of density to silviculture and forest administration goes further. In forest administration, whether national, regional or strictly local, a ready method of determining the density of the wood in standing timber would be a tremendous aid in adjusting lumber supply to market needs. For example, if the market for structural timber were overloaded, with prices depressed, the Service would possibly not desire to place on the market large tracts of timber which ran high to structural timber, whereas, if conditions were reversed, if the market were in urgent need of structural material, those tracts containing large amounts of timber of the required density could first be thrown on the market with a minimum accumulation of so-called side lumber. In a similar but smaller way, the lumberman could from a purely business standpoint, more advantageously select his timber for cutting so as to adjust his production to his market requirements. The full significance of the application is best visualized by the situation with respect to specific and exact requirements for wood for special uses such as existed during the war and the requirements as we now comprehend them, of a possible future war.

Closely allied to density of wood structure as a factor of strength is diagonal and spiral grain. By the former is meant wood in which the fibres extend diagonally (usually indicated by the annual layers of growth) across the piece on the radially cut surfaces, while in the latter the fibres extend in an oblique direction circumferentially around the tree. Logs are ordinarily sawn parallel to the axis of the tree, thus cutting the fibres obliquely and producing diagonal grain of varying degrees, depending upon the uniformity of the wood growth. It can often be satisfactorily taken care of by methods of sawing or manufacture, such as the innovation during the war of sawing parallel to the outside of the log instead of parallel to its axis, in order to get more straight-grain material for aircraft construction.

In manufacturing structural timber, it is not practicable to cut the timber so as to eliminate the effect of spiral grain. Consequently where strength is an important consideration, spiral grain is a factor which cannot be disregarded. In a series of tests on Douglas fir and Sitka spruce, recently made at the laboratory, the effect of diagonal and spiral grain upon strength was clearly established.² The weakening effect in the two species was the same. There was practically no difference shown between the effect of diagonal grain and the effect of spiral grain. The latter, however, is more difficult to detect and its weakening effect is more likely to be augmented by season checks. For both, it was found that some mechanical properties are affected by very slightly sloping grain, while others are not materially influenced until the slope becomes 1:15 (one inch in a length of 15 inches) or greater. For the aggregate of mechanical properties, the tests established that from the start strength decreases with increase in slope of grain. At a slope of 1:20 the rate of decrease becomes very rapid.

The data secured on this subject show conclusively that the tree in the forest which is badly spiral grained is not suitable for structural timber and should not be appraised on that quality. In order to arrive at a close estimate of structural quality of a tract of timber, the appraiser will likewise need a ready and reliable method of determining spiral grain in standing trees. None exists at the present time. Some trees, to be sure, show it by the very apparent twist in the bark; others do not. There may be some reliable surface or bark test which an intensive study would quickly reveal or it may follow certain laws or conditions of site which would find practical application in growth studies and timber surveys. We know less about spiral growth than we know about density or specific gravity of wood. Its cause has never been definitely determined. What, if any, is the relation between spiral growth and soil, light, climate, storms, injuries, species, wind currents, etc.? Is it transmitted from tree to seed and does the secret, after all, lie in the seed? Until some of these questions are answered through comprehensive studies in the forest, the practice of using seed from badly spiral grained trees in nursery and field sowing and in regeneration from seed trees may well be questioned.

In the foregoing, density and spiral grain have been selected merely to illustrate more specifically the intimate relation between research

² "The Influence of Spiral Grain on the Mechanical Properties of Sitka Spruce and Douglas Fir," by T. R. C. Wilson and R. F. Luxford, August, 1919.

in wood utilization and in the properties of wood to practice in the forest, whether it be in connection with administrative problems or silvicultural investigations. Almost every phase of research in forest products threads back to silviculture in some way and finds important application in forest practice.

In fact, the mechanical, physical and chemical qualities of different woods will not only determine the commercial value and application of each species, but will also, to a very important extent, determine which particular ones of a group of possible species should be grown or encouraged on any specified tract of forest land. In many cases a careful consideration of the properties of the wood, together with silvicultural requirements, may bring out the fact that better results can be obtained by growing some hitherto neglected species rather than the species which has previously been considered most desirable.

For example, grand fir (*Abies grandis*) has generally been considered inferior to white pine or Douglas fir in the forests of Washington and Northern Idaho. Yet natural regeneration of grand fir is more dependable and more easily secured on many cuttings and burns than either of the other species. This fact, together with its high form factor and rapid growth in dense stands, makes it silviculturally a very desirable tree for many sites. Studies of the properties of grand fir have shown that for many purposes it is equally as good as either Douglas fir or white pine. Consequently with this knowledge of its wood properties as his guide, the forester might often be justified in encouraging the reproduction of grand fir on many areas in anticipation of the time at the end of the next rotation when the prejudices of custom will have disappeared and the true commercial value and application of this species will be recognized.

Again, it has been quite generally thought among lumbermen that trees grown in swampy or inundated lands produce inferior lumber to the same species grown on well drained uplands. Experiments in kiln drying have shown that there is reason for this belief, that the swamp grown oaks, for example, shrink and warp more and are more inclined to honeycomb in drying than the upland trees. The same is true of other species, as gum, tupelo and cypress, etc. Moreover, the question of durability forms an important element as to location of tree growth. Is swamp grown lumber more durable than upland growth? These two questions—physical behavior in drying and dura-

bility—evidently bear a direct relation to conditions of growth and silvicultural treatment.

This relation between research in forest products and forest practice is more apparent in some lines than in others, and as our knowledge increases new applications will be revealed which may exert far-reaching influence upon forest practice. The field of wood chemistry may, for example, upon extended research, prove to be the "open sesame" to the silviculturist and alter entirely or in part his present methods of research. Whether considered from the point of view of immediate or of future application of results, the closest co-ordination of this research in forest products and forest administration is desirable and essential if our practice of forestry is to develop with balanced progress.

THE MANAGEMENT OF HARDWOOD FORESTS IN THE SOUTHERN APPALACHIANS

BY I. F. ELDRIDGE

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The spectacular rise in the price of all wood products during the last two years is due in great measure to the increased cost of manufacture and delivery, and to the resumption of building operations on a large scale after several years of inactivity. In the case of hardwoods, another factor shares largely with the high cost of production the credit of increasing values; that factor is the growing realization that the supply of virgin stumpage is rapidly drawing to an end in this country. It has been said that the greatest bar to the practice of forestry in this country is the low value of stumpage. If this is true, forestry can soon be expected to come into its own, in the eastern United States at least.

When the eastern forests are exhausted we must import practically our whole hardwood supply, for there is no enormous reserve of this much needed timber in the west as is the case with the softwoods. The date is not far distant when we shall buy mahogany and rosewood furniture at less cost than furniture of white oak from our own mountains.

The demand for hardwood stumpage and the growing difficulty of finding it are beginning to focus the attention of the lumber industry and lumber users in general upon the problems of maintaining our future timber supply as no amount of forestry propaganda has been able to do in the past.

In addition to the paternal concern which the Government feels in the matter of maintaining the sources of supply for such a great and vital industry, it is directly interested in the problem, being the largest single proprietor of hardwood forests in the country.

Under the administration of District 7 (Eastern District) of the Forest Service the Government owns approximately 972,124 acres of forest land in the Southern Appalachian Mountains, of which by far the greatest part is under hardwood forests. This acreage is organized for administration in seven National Forests, each under a technically

trained forester as supervisor, with the usual National Forest force of rangers and guards.

It has taken a number of years to acquire the lands and to get them organized and under administration. This necessary preliminary work has now reached a stage of development where the attention of the administration can be given to the big project of working out management plans for the timber now under control. The need for these plans has been most strongly emphasized by the eager demand for timber sales that has developed during the last two years and by the certainty that the future will see a constantly increasing demand as the depletion of private holdings drives operators to the National Forests for stumpage.

That a plan of management must be provided not only for each forest but for each working circle on each forest is beyond question. Unless provision is made to regulate the removal of forest products in such a manner as to assure a steady and sustained yield with which to maintain, or to do its share in maintaining, local industry the management must prepare to face violent and just criticism. Not only have the lumber industry and the local working population to be considered; if through a lack of proper management plans the mountains are denuded, without due and careful consideration of the stream protective and recreational values of the situation, a great and serious damage will have been done to a much larger portion of the public.

Before 20 years have passed the exhaustion of the hardwood forests in private hands will direct the attention of the public to the National Forests of the southeast and the Forest Service will be called on for an accounting of its stewardship. The situation, then, will be potent with possibilities which will bear directly upon the future progress of the cause of forestry and conservation in this country. Well thought out management plans are the best assurance that a satisfactory accounting will be rendered.

While the problems of management differ in nearly every one of the working circles on the seven forests of the Southern Appalachians, there are certain essentials common to all of the management plans:

1. The plan must be simple. It must be kept in mind that ultimately the general public will set itself up as a self-appointed judge of the rightness of the plan; it must be logical, easily understood, and convincing.

2. The plan must be practical to the *n*th degree. The day of the "paper" plan, replete with abstruse mathematical calculations of yield, but lacking a definite plan of management, has long since past in District 7. The district is ready for a delineation of activity that is to be undertaken at once and followed consistently.

3. The plan must be subjected to frequent critical examinations and revised as often as needed to keep it abreast of the times. The plan is not in itself an objective—results, only, will count.

Though possessing these three essential qualities in common, the prescriptions of management for the different working circles may and probably will differ widely. This is as it should be, since the success of the individual plan will depend largely upon the degree of exactness with which it reflects the particular economic and silvicultural circumstances of the working circle to which it applies. It would be a rare coincidence indeed to find two forest regions with the same economic and silvicultural conditions.

There are certain definite principles that should govern in the preparation of every management plan. Among these are:

1. The working circle and not the Forest is the unit of management. The Forest is primarily an administrative division and may contain several working circles. The working circle is an economic subdivision of a Forest; it is a forest region on which the limitations of topography, or the development of transportation facilities, or the existence of demand for forest products, is such that all of the stands within the region should be managed in connection with each other and under plans of utilization affected in common by these circumstances. In the Southern Appalachians the typical working circle is a mountain valley, three to five miles wide and ten to fifteen miles long, bounded on three sides by mountain ridges and having a town on a railroad, or a pike, at the lower end of the valley, the floor of the valley being agricultural land under cultivation and supporting a population accustomed to deriving half or more of its support from the forest.

2. Within the working circle the unit of treatment is the stand. The Southern Appalachian Forests were built up through the purchase of large and small tracts of timber, some entirely cut over, some lightly culled, and some untouched by the lumberman. Some of these tracts were cut over very recently and exhibit a stand of reproduction from one to ten years old. Other tracts, cut over at a more remote date, show a stand of poles from 15 to 25 years old. Some areas were culled only of certain species or sizes and consequently now show two stands on the same area, one of mature timber, the other of saplings or poles as an understory. Often, especially in the larger purchases, there are many differences as to the age and prevalence of stands in different parts of the tract. The term "stand," therefore, is

meant to cover not only an age or size class, but further to convey the idea of an age or size class standing in a body, to be considered as a unit of treatment previous to, during, and after utilization. The fact that two or more "stands" may occupy the same ground should not be allowed to confuse the conception.

It is absolutely essential to the success of the management of a given working circle that the stands composing the forest be correctly segregated and described and that the silvicultural needs of each be ascertained and provided for. This is the base upon which the entire structure rests.

3. No matter how correct the prescriptions of management may be, from a purely silvicultural point of view, the plan cannot be put into effect unless it is made to harmonize with the governing economic factors. It is footless, for instance, to prescribe that a certain stand be removed at once if it be inaccessible, and, therefore, unmarketable. While it is true that the silvicultural needs of a stand should indicate the plan of its management, it is evident that a certain amount of give and take must come into play and in some cases, even, the forester must be prepared to sacrifice silviculture for utilization or vice versa.

A thorough knowledge of all the factors concerning the relationship of local and distant industries to the business of the forest must be had in order to approach a reasonably correct forecast of conditions.

4. There is a third element that must be considered and given due weight in drawing up prescriptions of management for a stand or for a working circle: The Appalachian Mountains are fast becoming the playground of the South. For the women and children who dwell in that long stretch of flat country, which borders the seaboard from Washington to New Orleans, the mountains are the refuge during the long, hot summers; they are the hunting and fishing grounds of the men between seasons. Thanks to 35-cent cotton and 20-cent sugar, the South will be able to take possession of its natural recreational region from now on as it never has before.

In District 7 the recreational value must be given the importance it deserves. In some few instances, management plans will be based entirely upon recreational considerations. In many instances, plans for management will be strongly affected by the recognition of aesthetics.

In the typical working circle in the seven Forests of the Southern Appalachians the objects of management may be written as follows:

1. The production of the maximum amount of merchantable wood products per acre in the minimum period on the cut-over lands.

2. The regulation of the cutting of stands now merchantable with a view to making them sustain dependent industries, and thus also that part of the local population dependent upon the forest for a livelihood, during the period that must elapse before the immature stands (which usually form two-thirds of the forest) are ready for the market.

3. The sale and removal of dead and defective trees left on cut-over areas and not needed for seeding purposes. These are called "salvage" sales and at present form a very large part of the timber sale business of the district. Strictly speaking, they are improvement cuttings and are not subject to such strict regulation as are cuttings in the mature stands. Nevertheless, such sales will be used in many instances to increase the annual cut of the circle, especially where the percentage of mature stands is insufficient. In such cases a degree of regulation, such as a limitation of the amount that may be sold annually, will be provided for.

4. The planting up of areas where the mistreatment under private ownership has prevented natural regeneration. In some instances the planting of abandoned fields may be considered. There are approximately 48,000 acres of barren lands and old fields in the Southern Forests, of which 28,000 acres are of the former class. The work of reforestation must, because of financial limitations, proceed slowly and will probably extend over a period of 20 years or more.

It may be considered strange that the Government should be content with the production of the maximum amount of wood products per acre instead of endeavoring to produce species of great value, such as poplar, white oak, red oak, ash, etc. It may be said in explanation that it is not a matter of contentment altogether; the cut-over lands now being reforested by nature were not under the Government's control when logged and consequently it had no voice in the matter. The reforestation has already "set," so to speak, and cannot be changed now. The only thing that can be done is to encourage all of the growth per acre practicable, regardless of species. There is no doubt that every foot of wood will find a ready market by the time these stands mature. The writer remembers that less than 20 years ago cottonwoods and gum were both considered worthless and were generally thrown in free of charge in sales of cypress stumpage. About that same time, chestnut in the mountains of North Carolina was considered a weed tree. The advance of the pulp industry into the South is already making a market for species unmerchutable two years ago.

It is not intended to discuss the matter of silviculture in this paper, but it should be said in passing that in all sales on both mature stands and on young stands on cut-over lands the marking rules are drawn up to favor, in the seeding, the next generation of such species as poplar, white pine, white oak, chestnut, red oak, etc.

In arriving at the volume of cut to be made during any given period, this line of procedure is followed: As a result of the survey, the va-

rious stands of timber are segregated and described as to location and area. The areas are then studied carefully and divided into six or more classes, depending upon the length of rotation adopted, as follows:

Class I—	Main stand of timber, 1 to 20 years old
Class II—	Main stand of timber, 21 to 40 years old
Class III—	Main stand of timber, 41 to 60 years old
Class IV—	Main stand of timber, 61 to 80 years old
Class V—	Main stand of timber, 81 to 100 years old
Class VI—	Main stand of timber, over 100 years old

If the distribution of classes is normal, and the rotation is 120 years, it is evident that all of the areas under Class VI should be cut during the next 20 years, Class V during the following 20-year cutting period, Class IV the next, and so on, but, unfortunately, the actual distribution seldom even approaches the normal; there is nearly always a heavy surplus of area under Class VI or Class I, or both, with a very light representation of Classes, II, III, IV, and V. Class V is frequently entirely missing.

The comparison of the actual distribution of classes with the normal will indicate to the forester the points of attack in arranging the stands in his schedule of periodic cuts. For instance, if the classification shows a total lack of Class V stands, it may be necessary to extend or spread the utilization of the Class VI stands over two 20-year periods instead of cutting them in the current cutting period. In deciding just which of the Class VI stands are to be set up as Class V, the age and condition of the timber, the necessity and merchantability of the stand, and the needs of local industry are taken into account.

It will be hardly possible in any of the working circles to rearrange or reclassify the stands so as to show a permanent, uniform annual yield through an entire rotation, but this desirable end may be approached quite closely for the next two cutting periods, at least on most of the circles. When the various stands have been finally classified, as to the period in which they should be cut, taking all factors into consideration, the calculation of the cut per period is simply a matter of estimating the amount of timber to be expected (present stand plus increment) on the stands to be cut during that period.

Summarized, the system is: Divide the forest into its component stands: after studying the silvicultural needs of each stand and the economic factors affecting it, prescribe for its management. To ascer-

tain the cut for any period, add together the estimates of the timber to be expected on the stands which, according to the prescriptions of management, will be cut during that period.

The tendency toward a system of management by area, indicated in the procedure described above, will be checked by the frequent re-examination of the growing stock and the revision of the stand classification to take into account the changes brought about by the different site factors.

Now as to the plan: The visible evidence of it is contained in a brief report, with addenda in the shape of estimates and descriptions, and a map of the working circle.

THE MAP

The map is on a scale of 2 inches to the mile and shows graphically the following data:

1. Boundary of working circle.
2. Existing ways of transportation, such as roads, trails, flumes, tramways, railways, telephone, telegraph, and power lines.
3. Towns, settlements, forest utilization plans, farms, etc.
4. Topography by contours if data exist; if not, main features, such as streams, main ridges, etc.
5. Locations and extent of the different "stands." The age class (by 20-year classes) of each "stand" on the area is shown and if it belongs to a class slated to be cut within the next 20 years, the estimate of the amount to be cut is entered.
6. The cutting plan for the next five years: This is shown by designating the stands to be cut and the preferred order of cutting by cross-hatching or by coloring and numbers.
7. Areas needing planting.

THE REPORT

The report in brief consists of:

1. General description of soil, climate, topography, etc., for the whole circle. Explanation of map.
2. Discussion of economic conditions in full, including recreational values.
3. Forecast of probable development of industries, local and distant, future needs of population, growth of towns, development of means of transportation, etc.
4. Discussion of management survey, divisions into stands, estimates, rate of growth and general silvicultural conditions and needs. Objects of management.

5. Calculation of periodic cut with explanation and reasons.
6. Timber sale policy for the next ten years. Principles of marking, class of sales, material to be sold, brush disposal, etc.
7. Cutting plan for ensuing period (five years).
 - (a) Areas to be sold.
 - (b) Preferred order of cutting.
 - (c) Salvage material to be sold.
 - (d) Discussion of values.
 - (e) Marking rules, brush disposal, degree of utilization to be required and other items concerning sale administration.
8. Planting plans, if any.
9. Addenda.
 - (a) Detailed descriptions of stands, giving in full all data concerning species, quantity, quality, age; site class, estimates value, methods of utilization practicable, etc.

The survey should be made by men intimately acquainted with local silvicultural conditions and who have experience as to the silvicultural treatment most appropriate for the various stands. The forest supervisor must take a very active part in all decisions concerning management. In fact, the supervisor will, in most cases, dictate the policy section of the report.

The report with all data is then forwarded to the district forester for examination and approval. It is then passed on by the Branch of Management of the Forester's office and after final approval is sent back to the supervisor to be followed.

The control of the plan is most important; it is accomplished by frequent field inspections by the district staff. The plan and timber sale policy must not be allowed to grow old or outworn. It should be carefully examined with a view to revision at the end of five years, earlier if circumstances require.

REVIEWS

Guide to the Maltby Tract of the New Haven Water Company. By R. C. Hawley. Pp. 1-17. Jan., 1920.

Professor R. C. Hawley, of the Yale Forest School, has just published "A record of the various silvicultural operations on an area of woodlands known as the Maltby tract"—well known by all graduates of the Yale Forest School. The Maltby tract is an area of some 1,200 acres of mixed hardwoods and old fields, only two and one-half miles from the center of New Haven, owned by the New Haven Water Company, and capable of intensive management. The practice of forestry began on a portion of the area in 1900, and Hawley was made forester for the New Haven Water Company in 1907. This small forest, because forestry began here in 1900, will be well worth a pilgrimage for years to come. Admittedly much of the work has been experimental; this probably explains in part the planting of such species as Scotch pine, the preponderance of white pine over red pine, European larch, Norway spruce. The use of exotic species is surely to end in disappointment unless they are managed on a very short rotation, and the white pine would appear to be less desirable than the red pine. The use of jack pine is clearly experimental. What a pity that some of the plantations have been destroyed by fire! The silvicultural treatment usually applied to each type is, briefly, as follows:

"Hardwood type. As the stands reach merchantable size for cordwood, *which will ordinarily be between the thirtieth to the fortieth year,* a C-grade thinning is made, removing four to ten cords per acre. A second and a third thinning may be made at ten-year intervals, taking out four to six cords of wood. Between the sixtieth and eightieth years the stand is cut clear of lumber, ties, piles, and cordwood. Reproduction which follows consists of seedling and sprouts. The thinnings usually increase the amount of seedling reproduction. Even where a stand is cut clear without previous thinning good reproduction of sprouts and seedlings ensues.

"If the young hardwood stand, when ready for a first thinning, contains a considerable percentage of chestnut, a salvage cutting instead of a thinning must be made. This will usually remove ten to fifteen cords per acre, and leaves the stand so open that it will need no further thinning during the rotation.

"The question of whether it is financially better to continue to grow hardwoods or to transform the present hardwood stands to conifers is still an open one. That the transformation can be accomplished is proved by the results in comp. 2, sub-comps. 3 and 16. By setting the conifers farther apart, using only one hundred to two hundred plants per acre, the cost would be greatly reduced, and virtually a pure stand of conifers eventually obtained.

"Old-field type.—Wherever the stands are only partially stocked conifers are planted; otherwise the old fields are allowed to revert gradually to the hardwood type.

"Coniferous plantations.—Establishment is as yet the principal problem. The young plantations must receive cleanings as needed. On hardwood land two to three are required; on pastures and meadows rarely more than one, and sometimes not any. A liberation cutting is often required to remove large trees interfering with the conifers.

"It is believed that thinning can be made in the coniferous stands by the twenty-fifth to the thirtieth year. Pruning of selected trees will probably be a profitable operation.

"This is naturally a hardwood region and it will not be possible, in most instances, to reproduce the planted conifers by natural means. Probably clear cutting and replanting will be the system of management adopted."

T. S. W., JR.

Gila River Flood Control. By Frank H. Olmsted. Senate Document 436, 1919.

While not engineers, foresters may find this work of interest as it considers forestry and grazing in relation to floods in the Gila River drainage of the Southwest. The erosion of this stream is tremendous, single storms moving the channel of the stream many hundred feet and destroying a considerable acreage of fertile agricultural land. Could we shorten the geological history of this stream to the length of a single reel of film, the result would resemble the contortions of a bunch of tortured angleworms and go through gyrations that no self-respecting worm would think of doing.

The first step in the improvement of watershed conditions "will automatically be accomplished to a considerable extent by the control of grazing" as much serious erosion has been started by overgrazing and improper methods of handling both sheep and cattle. The second step is the use of check dams or small retarding works located in the stream channel from the headwaters of the river to below its dangerous marks to lessen the velocity, control the silt carried, and to flatten out the flood peak of the stream. To protect the banks from under-cutting, a system of floating gates is described. Much of the construction

material for this work must come from the National Forest areas at the head of the streams and the forest areas are therefore important from the supply standpoint as well as from absorption and erosion prevention.

It is interesting to note that Mr. Olmsted, who is a recognized authority on water conservation and engineering, believes thoroughly in forestry. He states that "it must be clearly understood that the basis for all of the work proposed for regulating run-off and in itself of more importance than any other feature, is the general condition of the watershed ground surface so far as its sod, brush, and timber conditions are concerned."

While this work will be of greater interest to all who are interested in this phase of forest influences, the book itself is open to some severe criticism. At the present time there is a great cry over the paper situation in the same Senate that issued this volume, and we find the backs of ten pages of plates are bare, twelve more plates have but one reproduction where two or more could easily be placed, and four pages are devoted to printing letters of transmittals which could easily have been printed on half of one page. As the publication measures 9 by 12 inches these defects are the more striking. Plate 14 is a picture $1\frac{1}{2}$ by $2\frac{1}{4}$ and Plate 7 is $1\frac{1}{2}$ by 6 inches, both occupying a whole page. Other defects equally derogatory are the lack of a table of contents and a summary of the necessary work to be done.

E. N. M.

Forests, Woods, and Trees in Relation to Hygiene. By Augustine Henry, M. A., F. L. S., M. R. I. A. London, Constable and Company, 1919. Pp. 315, illustrated with 49 photographic reproductions, figures, and maps. Price, 18s.

Professor Henry has done an admirable service for the layman as well as the forester in bringing out the book under review. Although the work is intended primarily for readers in Great Britain and Ireland it can be read with profit by Americans as well.

At no time in the past have so many people in all civilized countries been interested in the relation of forests to public health and hygiene. Although many pamphlets and articles in journals and magazines dealing with one or more phases of this subject have appeared in recent years, Professor Henry has given the English speaking people the

first popular and comprehensive treatment. The author says in his preface that a special effort has been made to interest the statesman, the student of economics, the engineer, the physician and the layman, as well as the forester in the effect of forests on certain aspects of public health and hygiene about which vague notions are now prevalent.

In the twelve chapters which make up the book an endeavor is made in the first two to recognize and describe the far-reaching influences of forests and trees on climate, flow of water, erosion of soil, shelter from wind, and the purity of air and water. Data are presented to show that these influences affect directly the health and comfort of man.

In the following three chapters statistics and data are assembled showing the value of forest districts as sites for sanatoria and also the importance of the parks and trees in towns and cities and their reaction upon the public.

For generations England has been engaged in coal mining which has left large areas of desolation in the form of pit mounds in the Black Country. Two chapters containing much new and interesting material are devoted to the general consideration of afforestation. Many illustrations are given of successful afforestation of pit mounds and similar waste land by planting. This movement is of great interest in England at the present time, particularly in localities where it has been taken up by school children. For instance, the Black Wagon Plantation, taken charge of by a high grade school, was a naked mound a few years ago consisting partly of grey shale and partly of shale mixed with slack. This huge, black, bald mound, formerly an eyesore to the district, is now covered with splendid trees. There are many similar areas of desolation in the mining regions of Pennsylvania and elsewhere in this country where in the reviewer's opinion the inhabitants might draw inspiration and example from the planting done by these school children in England.

One of the most interesting parts of the book is given to a rather detailed discussion of species suitable for the afforestation of various catchment areas in Great Britain and the results obtained from past planting. American foresters will be interested in the use for this purpose of many of our West Coast conifers, particularly Douglas fir. They will also be interested in the excellent photographic reproductions of many plantations of these species in England, some of which are well along toward economic maturity.

The information relating to specific catchment areas in Great Britain and Ireland was compiled from questionnaires sent by the author to town clerks and water engineers of towns and cities which drew their potable water supply from catchment areas. A hundred or more of these catchment areas are listed with approximate data. In fact, more than four-fifths of the entire book deals with the specific problems of these water catchment areas together with descriptions and maps of each.

The author points out that the history of the improvement of the various catchment areas throughout Great Britain and Ireland shows in how fitful a manner and on how small a scale this important civic and national work has been carried out in past years. In the reviewer's opinion the same may very well be said of the United States, where only in recent years and then only in certain parts of the country has serious attention been given to the improvement of watersheds that supply the potable water for our municipalities.

Taken as a whole, the book should fill a distinct need as a popular treatise on this important subject. It should also prove a valuable reference book for engineers and others identified with the management of water catchment areas.

The book is a well printed example of the bookmaker's art. The pages are uncut and the many photographic reproductions are admirable.

J. W. T.

Éléments de Sylviculture. By Comte Félix Goblet d'Alviella. Marcel Rivière, Paris, 1919. Vol. I, pp. 383; Vol. II, pp. 269.

M. Goblet, an estate owner in Belgium, has published an elementary book on silviculture (*and protection*) which, according to M. Crahay, director of the Belgian Forest Service, who writes the preface, contains much good advice and is especially opportune in Belgium, because government foresters have no time for writing books! The author in his "Avant-Propos" makes some interesting conclusions regarding the German destruction of Belgium forests, which he claims was not only for military uses but also for *trade* and in order to *destroy* and *ruin* the country. It is a severe arraignment when one considers the position of Belgium in the war. No timber was paid for, and "in most cases no account was rendered the owner of the (wood) material that had been removed." There was an actual confiscation of capital, "a

theft," which was systematically organized and carried out. M. Goblet estimates the loss as follows:

(1) Ten thousand three hundred and seventy-eight acres of state forest destroyed, of which 2,471 acres was in the forests of Hertogenwald and Grünhaut, and 1,977 in the forest of Ardenne.

(2) The communal and institution forests were heavily cut, especially at Virton, Floreville, Palisoeul, Bertrix, Libin, Chimay, and Tournai.

(3) Private forests suffered heavily, and at Sainteode *it will take three years to log the trees felled*.

(4) In Flanders there are no merchantable conifer stands left. Military operations destroyed 6,178 acres of forest in this department alone.

(5) The direct damage is more than 19 million dollars, based on 1914 prices! With the indirect damage to soil, coppice, roads, and young stands, the total loss is estimated at close to 193 million dollars.

All this serves to illustrate that it will take years to restore normal forest conditions incident to destruction and over-cutting.

The two volumes include a description of the species, the silvics of trees, system of management, sowing and planting, thinning, damage and protection, logging methods from the standpoint of silviculture, as well as chapters on forest working plans and forest law. There are no less than 120 illustrations. Judging by the footnotes much has been borrowed from French sources, but imagine an American estate owner writing a similar treatise! But it is essentially a popular book for estate owners and not a text book for technical foresters.

T. S. W., JR.

PERIODICAL LITERATURE

SILVICULTURE, PROTECTION, AND EXTENSION

Many years ago Hartig planted acorns of *Notes on the Quercus pedunculata* of different sizes and *Germination of* studied the process of germination and early *Quercus Serrata* growth of the seedlings. He concluded from his experiments that the larger seed not only gave a

higher percentage of germination but, more *important*, that the seedlings were more vigorous and made a more rapid early growth. In cases where the seedlings were adequately close those from the larger seed ultimately overtopped the others and suppressed them. Rodger has recently studied the germination and early growth of *Quercus serrata* in India. In the autumn of 1916 a quantity of the seed of the above species was collected and 200 of the larger and an equal number of the smaller were sown in adjacent beds in good garden soil. A year later all the seedlings in the two beds were removed, counted, and measured with the following results:

<i>Size of acorns.</i>	<i>Number of seedlings found.</i>	<i>Average height of stem in inches.</i>	<i>Average length of root in inches.</i>
Large.	108	4.4	17.2
Small.	94	5.8	17.4

Contrary to the conclusions of Hartig these experiments appear to show that the size of the seed has little or no effect on germination and early growth, and consequently upon the crop that may be expected from the sowings.

The writer realizing that the data obtained from his experiments are too meagre for definite conclusions, suggests that similar data be collected for various Indian species. Specific data on the effect of size on the quality of seed are needed for American species. The necessary data can be easily secured and the point should be definitely settled so far as our economic species is concerned.

J. W. T.

Rodger, A. *Notes on the Germination of Quercus Serrata*, Thunb. *The Indian Forester*, Vol. XLV, No. 12, pp. 631-632.

POLITICS, EDUCATION, AND LEGISLATION

*General
Reorganization
of the Police*

The minister of the interior has asked all the municipal councils in France for suggestions on a proposed law which he plans to present to Parliament transferring to the authority of the prefect the greater part of the police powers which the municipal authority now exercises in accordance with the law of April 3, 1884, and organizing a rural police which will replace the present institution of rural guards. The proposed law is of interest to foresters and forest owners because it would afford better protection to private forests than the present system.

S. T. D.

Un projet de loi "tendant a la reorganisation generale de la police." Ch. Guyot. *Revue des Eaux et Forêts*, 57:100-103. 1919.

*Is Socialization of
Forest Industry
Practical?*

Although they differ as to methods for accomplishing it, most socialists agree that the forest industries should be socialized in order to avoid the anti-social effects of possible monopoly, to guarantee the maximum sustained production at the minimum cost, to assure continuity of employment and of supplies of forest products, to allow the State to regulate the disposal of forest products, to assure the delivery of material imposed by the peace treaty, and to keep prices lower than they would be under private ownership. The author holds that monopoly is not possible, since the average size of the large holding in Bavaria, for instance, is only 500 hectares, while most of the private forests are held by a multitude of small owners whose average holding is only a little more than 3 hectares. Production on larger private forests is now as great as on State forests, while peasant woodlots cannot be interfered with without in many cases making it impossible for them to carry on farming. To reduce the wealth of private citizens will impair the credit of the State, and will make it harder to fulfill the treaty obligations. Moreover, if the private forests are turned over to the State their yield can be seized upon as part of the indemnity and will not be available for domestic needs. Under State ownership there would probably be less efficiency, due to bureaucratic inertia and political influences. The State already owns enough of the forest area to check monopoly and

price manipulations, especially when taken in conjunction with the large areas of communal forests, and to produce material of species or sizes which private owners cannot grow at a profit.

The State is in no financial condition to buy the private forests, even by a bond issue, since forest properties will not pay a return as high as the interest rate on bonds; confiscation without recompense to the owners is unthinkable.

Another proposal is to syndicalize the forests—turn them over to the forest workers. This is far less practicable with forestry than with other industries, because of the nature of the crop, which makes it impossible to discover and correct mistakes in less than 100 years, in many cases. The standing timber is both capital and product, with no sharply drawn line to distinguish between the two; overcutting, which would be likely, would be equivalent to destroying the machinery in a factory, but could not be remedied as quickly or easily. Forest industry does not permit year-long employment for most of the workers, since lumbering is mostly done in winter, for silvicultural reasons. The interest of the general public in forest properties, now represented by the taxes received from them, could not be as readily maintained if they were syndicalized.

Still another proposal is to divide up the forests. There is no such reason for this in Germany as in Russia or Hungary, where holdings of 20 to 40,000 hectares are common, and besides, small units are contrary to the fundamental requirements of efficient forest production.

The conclusion is that the great diversity of forest industry precludes the schematic treatment and bureaucratism inevitable with socialization, but that the best means for a democratic state to control the industry is through its powers of taxation. Forest owners must not overlook the justifiable demands of the socialists, which can be met by adoption of an up-to-date forest law to guard against misuse of the forest, and by the introduction of a reform in management on a voluntary co-operative basis. The law should require that forests of more than 100 hectares be managed according to a working plan, under continuous technical supervision. Beyond this, the owner should have entire freedom of action. For smaller tracts, the owners should have a choice between co-operative bodies or the looser form of forestry associations. These societies, federated on a nation-wide democratic basis, would make available the best technical assistance even for the smallest owners, and would afford other advantages, such as easy credit terms to

meet obligations without premature cutting of timber; testing and providing machinery, tools, fertilizers, seed and plants; uniformity of conditions of forest employment; education and information of members in up-to-date scientific and technical matters. The State, by proper supervision of the associations, could keep their activities in the right channels and guard against the development of a trust injurious to the public interest.

W. N. S.

Hoffman. *Ist die Vergesellschaftung im Forstbetriebe möglich?* Forstwiss. Centralbl. 41:210-226. 1919.

MISCELLANEOUS

*Improvement
of
Forest Roads*

Forest engineers have been too given to the use of straight lines in laying out forest roads, with the result that the latter can not always be used satisfactorily for the transportation of forest products. This difficulty should be avoided

by using curves to carry roads around obstacles such as lakes, cliffs, and ravines. Methods are given in some detail for laying out reverse curves and for constructing directly the arc of a circle by means of an inscribed regular polygon.

S. T. D.

P. F. *Amélioration des chemins forestiers.* Revue des Eaux et Forêts. 57:69-74. 1919.

NOTES

EFFECT OF GROUND COVER AND LITTER

Reproduction studies of western yellow pine at the Fort Valley Experiment Station are bringing out some interesting data regarding the effect of ground cover and litter. In connection with sample plot work some fifty 5 by 10 foot plots were thoroughly worked up with a mattock in 1914 for comparison with natural plots adjacent. This year's counts almost invariably showed more seedlings of 1919 germination on the natural than on the cultivated plots. The exceptions occur where a considerable amount of leaf litter covers the soil. Under these conditions the cultivated plots often contain seedlings at the rate of 400,000 per acre, and from 50 to 100 per cent more than the adjacent natural plots. The explanation of this phenomenon lies in the fact that a cover of organic matter, particularly where it has formed a thin layer of mould on the surface of the soil, is a distinct aid to germination. Deep cultivation destroys this cover, and also tends to increase the clay content of the surface layer by bringing up clay from below. An adobe soil treated in this manner becomes very compact on top after two or three years. Thus, while cultivation increases the moisture content by eliminating competing vegetation, it may prove detrimental to reproduction by forming a poor seed bed. This, however, is not the case if the ground is seeded before it has become compacted.

The above results are strikingly confirmed under a different set of conditions in a treeless clay flat surrounded by virgin forest. This flat which is virtually a small "park" is about 150 yards in diameter. The surface is smooth, free from stones and strongly compacted by overgrazing. Perennial grasses have given way almost entirely to "six-weeks grass" a short annual grama of small forage value. Clumps of *Senecio spartoides* and several similar unpalatable weeds occupy about 15 per cent of the ground surface. Counts in the middle of this opening showed 13,000 seedlings of 1919 germination per acre, while near the south side, 75 feet from the edge of the timber, there were 25,000 per acre. The tendency of seedlings to group themselves in and around the weed slumps was so conspicuous that a plot 5 by 20 feet was charted to scale, showing the location of all seedlings and weed clumps. It was found that 58 per cent of the seedlings were in the weed clumps which

occupy only 13 per cent of the total ground surface. On this basis it appears therefore that the weed clumps are almost eleven times as favorable for germination of yellow pine seed as the intervening bare areas. Another plot nearer the seed trees gave a ratio of 15 to 1 in favor of the weed clumps. A survey of about one-half acre in the middle of the park gave 37 seedlings estimated at ages varying from 4 to 10 years, almost all badly injured by sheep. Of the total number 19, or 51 per cent, were in weed clumps which occupy not to exceed 15 per cent of the ground area, thus indicating that the chances for establishment and survival are roughly seven times as great in the clumps as outside.

It is a matter of common observation on the Coconino and Tusayan National Forests this year that first-year seedlings are most abundant, other factors being equal, where there is a moderate amount of litter, slash or growing grass and weeds. This is true despite the fact that rains have come with such regularity that the surface soil has scarcely been dry to a depth of two inches since July 1. On bunch grass areas, seedlings grow right in the middle of a tuft where they find excellent shelter from drought and frost and protection against sheep which do not graze the coarse bunch grasses closely. On fenced sample plots where the bunch grasses form a dense growth two to three feet tall apprehension has been felt lest the seedlings be suppressed. Examinations on two such areas fenced ten years ago dispell this apprehension since seedlings 3, 4, 6, 8, and 10 years old are beginning to show up in surprising abundance, while outside the fence where the grass is kept down by cattle and sheep, scarcely a seedling is to be found, aside from those of the present year's germination.

G. A. PEARSON.

FORESTRY IN THE PULP BUSINESS

Hornblower & Weeks, a reliable banking house of Chicago and Boston, is financing an issue of \$7,500,000 worth of 6 per cent serial gold debenture bonds for the Brown Company (formerly the Berlin Mills Company of New Hampshire).

In describing the property the circular says: "A practically perpetual supply of raw material is assured by ownership in fee simple of more than 400,000 acres of timber land in Maine, New Hampshire and Vermont, and with the acquisition of Canada, Brown corporation has more than 800,000 acres in fee simple and stumpage of about

1,700,000 acres in timber limits under perpetual license, total holdings are over 4,530 square miles, conservatively estimated to contain fifteen million cords."

In another part of the circular under the heading "Property" it is stated that "this supply is sufficient for about 40 years, and actually much longer, *as the supply is conserved by the purchases year by year of pulpwood in the open market.*"

Accepting these figures as substantially correct, and dividing the estimated total supply of 15 million cords by 40 years, the estimated duration of supply, we have an approximate annual consumption of 375,000 cords per year. Probably the consumption on account of purchases is more than this, but for the sake of argument let us assume that it is correct. If the 2.9 million acres, which the company claims to own or control, would produce one-tenth of a cord per acre per year there would be a perpetual supply of 290,000 cords, about four-fifths the required supply. If, on the other hand, the land could be managed as perpetual forest to produce one-fifth of a cord per acre per year the land would produce 580,000 cords, or an amount ample for the Company's supply.

Looking at the question of growth from another angle, let us suppose that the present estimated capital of 15 million cords was growing at the rate of 2 per cent per year, then the growth would be about 300,000 cords. Whether these rough figures are correct or not, it is certainly significant that a large and successful pulp company in floating a bond issue makes no claim whatsoever on the basis that they are practicing forestry, but instead deliberately informs the bond owners that their forest capital will be used up in 40 years but that it will last "actually much longer as the supply is conserved by the purchases year by year of pulpwood in the open market."

If the campaign against the destruction of forests is to be successful, certainly large pulp companies like the Brown Company should take the lead in raising forest crops.

T. S. W., JR.

EFFECT OF THINNING AND PRUNING ON DIAMETER GROWTH OF WESTERN YELLOW PINE

In June, 1911, an empirical study was undertaken on the South Fork of the Payette River watershed on the Payette National Forest in

central Idaho, the object of which was to determine the effect of thinning and pruning on diameter growth of western yellow pine. The stand consisted of a dense growth of seedlings and saplings. Diameter measurements were taken with a steel tape at $4\frac{1}{2}$ feet above the ground on 30 medium sized saplings, ranging from 2 to 7 inches in diameter breast high and averaging approximately 18 feet in height, on 3 areas which were treated as follows:

Area 1. Thinned by cutting out about one-half of the saplings, leaving the remaining trees standing from 2 to 8 feet apart, the average distance being about 6 feet. All diseased, defective, and suppressed saplings were removed. The saplings left standing were pruned to a height of about 8 feet.

Area 2. This area was thinned as in Area 1, but the standing trees were not pruned. The trees left standing were from 2 to 10 feet apart, the average distance being from 6 to 7 feet.

Area 3. This area was left in its natural condition to serve as a check on the other two areas.

The same trees were remeasured in June, 1918, seven years later. Since no height measurements were secured at the time the plots were established no information is available on height growth or increment. The data on diameter growth are summarized as follows:

	<i>Area 1, thinned and pruned. Inches.</i>	<i>Area 2, thinned but not pruned. Inches.</i>	<i>Area 3, no treatment (control). Inches.</i>
Average d.b.h., 1918..	4.79	4.54	4.25
Average d.b.h., 1911..	3.67	3.59	3.57
Periodic growth for 7 years	1.12	0.95	.68
Periodic annual growth	0.160	0.133	0.097

It is evident that the removal of the diseased, defective, and suppressed trees from a western yellow pine stand results in an increase in the rate of diameter growth of the remaining trees. The response to an increase in the amount of growing space is more pronounced in the younger age classes.

C. F. K.

BLACK WALNUT IN UTAH

Black walnut was planted in Utah as early as 1866. George Ritter, living $4\frac{1}{2}$ miles southwest of Ogden, had as a part of the load which

he brought West in his prairie schooner from Pottawattamie County, Iowa, two bushels of walnuts. The walnuts were planted in the fall of 1866, 52 years ago, with the idea of forming a windbreak about the farm buildings and at the same time producing lumber with which to build a new house. These windbreaks represent one of the most western extensions of the natural range of *Juglans nigra*.

The trees stand very crowded in the rows. This crowded condition has retarded their development. Some of the dominant trees are 23 inches in diameter and have reached a height of 70 feet with a merchantable length of as much as 36 feet. Had the trees not been planted so densely it is safe to assume that the general development would have at least equalled that of the dominant trees, which average 17 inches in diameter d.b.h., have an average total height of 65.5 feet, and a merchantable length of 14 feet. There are in all 149 trees.

The trees are growing in the alluvial bottom adjacent to the Weber River. The soil varies from a rather light brown, fine sandy loam to a silt loam containing a considerable admixture of gravel. It is reported that at the same time the above trees were planted other walnuts were planted in the higher country nearby, where a rather pronounced hardpan had developed, and although properly irrigated they soon died.

Fruit is borne prolifically and the owner estimated the average crop at present to be about 100 bushels. The current market price is \$2.40 per bushel. The owner has received from these walnut trees a valuable return for his efforts through the sale of the fruit in addition to the protection of his ranch.

These trees would yield suitable gunstock, furniture square, and veneer material. Spiral grain is present in some of the trees to such an extent as to preclude their use as airplane propeller material.

C. F. K.

WORK FOR THE NEW FORESTER

At the time of writing the new Forester has not been appointed. Unquestionably, he will be a man fitted for the responsibilities as head of the Forest Service, U. S. Department of Agriculture. What work confronts him? It seems to me that his program should be somewhat as follows:

1. Prevention of private forest destruction.

2. A campaign for more widespread and better protection from fire on private, State, and National Forests.

3. A better personnel and better salaries in the Forest Service, with possibly some reorganization. Has the time come for "district supervisors," with more authority than the present supervisor has and greater responsibility?

4. Obligatory regulation and no more long-term sales (with the possible exception of Alaska).

5. Development of road and railroad transportation to tap timber now going to waste.

6. A continuance of research and especially more investigation along forest management lines, and to determine damage to reproduction from grazing of goats, sheep, cattle, and horses.

7. The appointment of a National Forest Advisory Committee from outside the Forest Service, to meet once or twice a year at Washington and discuss with the Forester economic and other problems.

T. S. W., JR.

A WORD ON REVIEWS

Many of the reviews published in the JOURNAL OF FORESTRY lack the critical analysis which make reviews so well worth reading. *Too frequently they merely give a synopsis of the subject matter* without commenting on the quality of the conclusions. Those interested in studying reviews of the first water by those foremost in their several professions would do well to look over a number of *The Yale Review*, which is to be found in all large public libraries.

T. S. W., JR.

FINLAND'S 1920 AGRICULTURAL BUDGET

The Finnish Ministry of Agriculture has estimated its budget for 1920 at 68,617,400 Finnish marks, an amount exceeding the budget for 1919 by 21,500,100 marks. The largest single item is that of forestry, being estimated at 8,800,000 marks, or nearly 13 per cent of the total; redemption of tenant land comes next with 6,000,000; land improvement, 4,000,000, and reclamation and terracing of swamp land, 1,500,000. There is also a considerable item for colonization.

Last fall the force at the Great Basin Experiment Station, Ephraim, Utah, made a very satisfactory demonstration of a new use to which an automobile may be put. The supply of wood for the ensuing winter was sawed by means of a 20-inch circular saw driven by placing the belting over the rim of the rear wheel of a Dodge automobile. Seven cords of pole wood were sawed into stove lengths in seven hours at a cost of little under \$2 per cord. The outfit worked excellently in sticks not over 8 inches in diameter. For larger pieces a 30 or 32-inch saw would have been better as it was necessary to turn the larger logs.

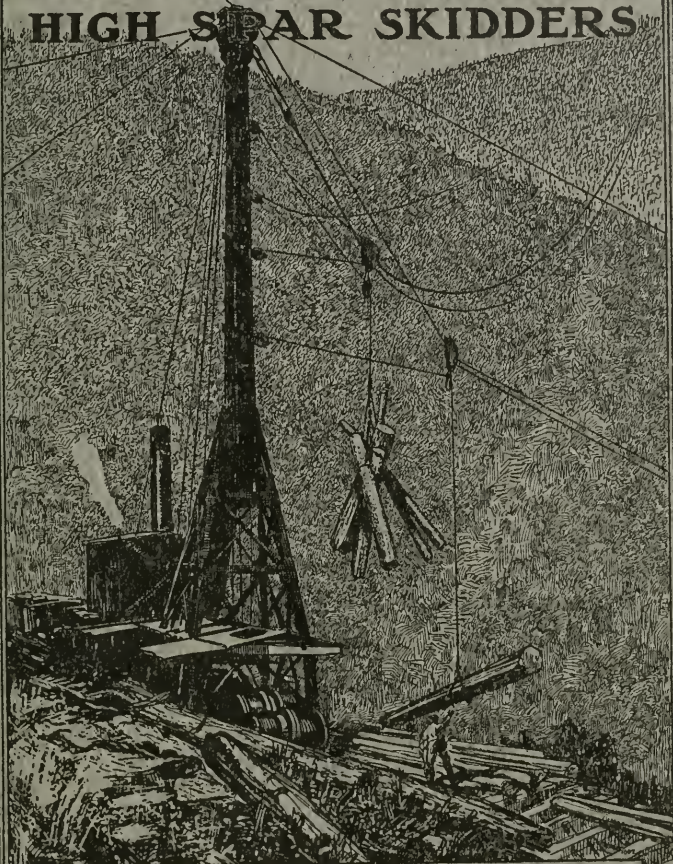
A unique and interesting timber sale was made recently on the Manti National Forest in central Utah. *Quercus gambelli* and *Acer grandidentatum* from 1 to 4 inches in diameter breast high and averaging approximately 50 years old were cut in 4-foot cordwood lengths, and were sold at a stumpage rate of 50 cents per cord. This material was shipped to an Ogden packing house where it was used for smoking meat. It is reported that the operator sold the cordwood at \$8 a cord f.o.b. Ephraim, Utah.

A considerable development in forestry is taking place in the Balkan region. Issues of the Oest. Forst und Jagd Zeit. for the latter part of 1919 have numerous items dealing with developments in this region, including the establishment of provincial offices for forests and agricultural administration in Jugo-Slavia, a new forestry association in Bosnia-Herzegovinia, and the establishment of a forest school in Sarajevo offering a two-year course.

Prof. S. N. Spring has resumed his work as professor of Silviculture at Cornell University on January 1. Since his return from France he has been teaching silviculture, forest law and policy in the Department of Forestry, University of Missouri.

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BUSINESS PHASES OF FOREST DEVASTATION

BY FREDERICK E. OLMSTED

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The provisions in the report of the Committee for Application of Forestry which suggest that certain business phases of the lumber industry be put to rights resulted in controversy hardly less interesting than that brought up by the recommendation for national rather than State control.

Opposition has resulted on the ground that foresters are not concerned with problems such as that of the relation between employers and employees, and that they should confine their efforts strictly to those measures dealing with the use of land for the growing of trees; that if we enter the business field at all it would be necessary to include such matters as the control of prices, capitalization, and other features; and that the business conditions recommended for control are not necessarily involved in a plan to keep forest lands productive.

SILVICULTURE A BUSINESS

The Committee was loath to introduce any reference to business problems into its program. It did so, after thorough-going discussion, only because it felt forced to do so, and for the reasons which follow.

Silviculture is a business, so interwoven with problems of labor, production, distribution, and costs as to be influenced profoundly by these factors from the very start. When the principles of forestry are applied in the woods, thus keeping cut-over lands productive, logged-off areas which in general have heretofore been charged off against depletion, should and will be regarded as assets. The lumber industry should not and will not be classed as a "wasting" industry, as it is now classed, for example, by the Bureau of Internal Revenue in connection

with the income tax. Timber, unlike coal, is a renewable resource, and the public demands that it be treated as such. The application of forestry, therefore, implies a fundamental change in the business structure of the lumber industry, a change which directly concerns the public welfare.

Under forestry the costs of keeping forest lands productive may be charged off currently. The lumberman will not be obliged to hold his cut-over lands, although he is now doing so in the great majority of cases, even when his lands have become worthless through devastation. If he sells them later on to the Government, the State, or to private interests, will not lands supporting young stands of timber be decidedly more valuable than devastated tracts? The lumber industry is not fighting against the imposition of added production costs, which it pretends may be made excessive; it is fighting against the principle of Federal or State control of any part of its business.

COUNCILS OF OPERATORS

The proposal that the lumber industry should create suitable machinery for transacting business with the Government seems to have caused an undue ripple of excitement. It is suggested that the operators in each economic forest region should voluntarily form councils, or boards, or committees—call them what you will—and that the Government should grant official recognition to such bodies. From these regional councils national representatives would be chosen to act for the industry as a whole. As the essence of the Committee's plan is to place all possible authority in local hands, the bulk of the negotiations would fall to the regional councils. The organization should, in fact, be still further localized, the various economic forest districts within each region being represented by district councils. It is taken for granted that the lumber industry would be glad to form such councils. If it should fail to do so, which is hardly conceivable, it would certainly be wise to give the commission authority to create equivalent agencies. Organized representation of lumber operators would seem to be one of the first essentials of good administration.

COUNCILS OF LABOR

In dealing with councils from the employees the Forest Service would, of course, be chiefly interested in the woods workers and in

such matters as might concern the carrying out of silvicultural and protective regulations in logging operations. Discussions of the labor problem as more commonly understood—that is, wages, hours, living conditions and so on—would be undertaken not by the Forest Service but through joint boards of operators and labor, made up of equal representation from both groups, with, perhaps, provision for an impartial umpire in case of deadlock. If the Government is to recognize organized operators, the justice of recognizing organized labor through boards of its own choosing needs no comment.

The science of keeping forest lands productive calls, among other things, for the skillful treatment of standing forests when they are harvested, involving much more than the mere slashing down and transporting of timber. Forestry requires intelligent, skilled labor in the woods. In order to obtain and hold good men for woods work it is essential to make employment as permanent as possible, and so to adjust conditions that the workers will be interested in and satisfied with their jobs, transforming the present "blanket stiff" type of labor into that of the decent, self-respecting, home-making citizen. The woodsman must first be contented with his job if we are successfully to begin the practice of forestry. After that, in view of the fact that forestry insures permanency to the lumber industry, forestry itself will develop and hold competent labor in the woods. The labor problem is, therefore, fundamentally involved in the stopping of forest devastation.

JOINT COUNCILS

That operators and workers should meet in joint councils has been viewed askance. Why should the Forest Service concern itself with an industrial problem of vital importance not only to lumbermen but also to all the great industries of the country? Should we not steer clear of such entanglements?

Except for the adjustment of matters essential to the application of forestry in the woods, the Forest Service would not concern itself at all with labor. It would stick to its own business. The commission merely offers the lumber industry an opportunity to adjust its own labor problems through mutual understandings arrived at in bi-party councils, a democratic method of procedure already practiced throughout a great part of the world and now applied by many of the more progressive industries of the United States. In cases where the Government could

be of assistance the Department of Labor or the Federal Trade Commission, not the Forest Service, would aid in reaching satisfactory adjustments. Wherever possible it is most desirable that the industry itself develop the capacity for self-government and only call in an umpire in case they cannot agree.

More human relations between capital and labor will not be brought about all at once through the application of any one plan to all industries. They will be of slow growth, attained in different ways by different industries. The Committee simply provides for the creation of agencies through which the lumber industry may start to adjust its industrial disputes in a democratic way, casting aside its archaic methods of industrial autocracy, which, as time goes on, will prove increasingly ineffective and dangerous. The plan is similar to that more recently suggested by the President's Second Industrial Conference for the establishment of regional and national industrial boards, and if that plan should become effective the lumber industry would, of course, function under it.

What has all this to do with the prevention of forest devastation? Simply this: The practice of forestry on privately owned timberlands would be extremely difficult, if not hopeless, apart from the practice of such industrial democracy as is necessary to secure and hold intelligent, contented labor.

BUSINESS REPORTS

Periodical reports on production, orders, shipments, sales, distribution and stocks on hand might be made either to the Federal Trade Commission or to the Forest Service. The cry that the preparation of such reports would throw a huge burden upon the individual plants of the industry is wholly unjustified, for the various mills of the principal lumber associations already make such reports to their own associations. The submission of this information to the Government would insure accuracy of statement, a thing much to be desired. The Government would also receive reports from mills outside of the lumber associations, thus making the statistical information fairly complete. If reports should be made to the Forest Service, that organization would, perhaps, be in a position to issue monthly reports for the country as a whole, as is done in case of agricultural products by the Bureau of Markets, thus keeping up to date on the situation. Reports of this

nature would contain merely such information as the public is quite justified in having from any great industry, and particularly from an industry dependent upon a vanishing natural resource of high importance in everyday life.

As to costs of production, the public, while grudging no one a liberal profit on his investment, is in no mood to be kept in the dark on this subject. The Government, at any rate, should be fully informed about costs of production at all times; the public should be informed whenever the public interest warrants. In order that the Federal Trade Commission may obtain accurate data on costs of production, standardized accounting systems would seem desirable.

The Committee believed that frank publicity on such matters was indispensable to a fair understanding as between the public and the lumbermen; it believed that if such publicity obtained there would be no necessity at all for what opponents of the plan call "complete Government control"; and it was distinctly opposed to complete Government control, in particular to Government price fixing. Public control of and public information upon some of the more important business phases of the industry seemed, however, quite essential to any effective plan for keeping forest lands productive.

PRODUCTION, COMBINATION, AND GOVERNMENT CO-OPERATION

The clause relating to the control of production was inserted by the Committee with the idea that it would assist in stabilizing the lumber industry. It was designed to prevent wasteful over-production, or at least to minimize so far as possible the evil effects of over-production. The injuries resulting both to the industry and the public through the demoralization of the market and the wasteful use of a dwindling resource need no discussion. It was believed that the lumber industry itself, in spite of the prickly problem of bonded indebtedness, might be able to suggest some sort of a workable plan which would largely forestall any serious over-production, and that the Government might give force to such a plan. Optimism as to the future demand for lumber now reigns. Would it not be wise, however, to think the matter over in preparation for a possible rainy day later on?

The reference to the combination of lumber manufacturers explains itself. "To sanction the co-operative combination of lumber manufacturers for all purposes resulting in economies of production and

marketing whenever, in the judgment of the Commission, such co-operative combination will promote the public interest." The recent railroad legislation and the decision of the Supreme Court in the case of the United States Steel Corporation indicate the futility of trying to force competition when whatever doubtful competition might result brings only losses to industry and the public. If combination, under efficient control, results in the best use of an important natural resource, and at the same time brings stability to an industry vital to the country's welfare, why not allow it and control it? ¶

The proposal to authorize the Secretary of Agriculture to carry on such operations on the National Forests as may be necessary to harvest forest products, has two ends in view. First, to afford the Forest Service a much-needed opportunity to apply the principles of forestry in operations entirely under its own control, transacting the business ventures from stump to market. Government operations of this character, extending over a period of years, should furnish excellent examples of what it is possible to accomplish in silviculture, protection, and industrial conditions. Second, to place the public in readiness to meet any possible emergency which might justify it in producing and marketing its own timber for the protection of its own interests.

These provisions, from the Committee's viewpoint, appeared to have a direct and important bearing upon the success of the plan as a whole, and were considered to be measures of great usefulness in keeping forest lands productive.

FORESTRY AND LABOR

By F. A. SILCOX

The definition of forestry must be broad and inclusive enough to cover all of those correlated factors which determine the practicability of making a "timber cropping" vs. "timber mining" program effective. It is almost like arguing an axiom to argue this point. Surely forestry must concern itself with something more than a study of parenchymatous tissue in trees.

Some analysts have said that 85 per cent of all business processes are the same and that about 15 per cent is technique, which means that any technical profession in order to fully redeem the responsibilities must recognize and operate in the general field of business and utilize those structures common to all groups—the banking, legislative, labor production, distribution and the like.

Labor is most certainly vitally affected by the economic condition of the lumber industry and the character of forest exploitation growing out of it. The "womanless, voteless, and part of the year workless," "blanket stiff" lumberjack is just as much a product of forest exploitation by devastation as the community, home-owning citizen is of forest conservation. Every industry must certainly come to realize that among its products are men who are good citizens as well as materials which are saleable, if it is to measure up to its responsibilities. Particularly does this apply to such a basic industry as lumbering, which has in its trusteeship great areas of virgin timberland inherited by all of the people with the continent they occupy as commonwealth.

Perhaps no industry in the country has had and is continuing to have more "labor trouble" than the lumber industry. The I. W. W. organization has flourished in the logging camps and their destructive type of radicalism is in many cases the direct result of the failure of forestry to lay the foundation for permanent communities, with home life, and because of the archaically feudalistic conception of the industry generally as to the right of the employees to organize and share with capital and management a voice in the councils of the industry—particularly concerning those immediately vital things that affect directly the workers' interests.

The organization of councils of operators and labor equally representative of both employers and employees is in direct line with what is being done under the so-called Whitley councils in England, and in the most progressive industries in this country, notably printing, bituminous and anthracite coal, stove, clothing, and others. Is the lumber industry going to adopt democratic industrial relations policies voluntarily, or is it going to continue to challenge the democratic forces of the country to see that it does?

EFFECTS OF DESTRUCTIVE LUMBERING ON LABOR

BY BURT P. KIRKLAND

University of Washington

The general effects of destructive lumbering on labor have within recent years been so much discussed, that without detailed research little can be added to what is already known. No investigator has devoted adequate time to this field to state positive detailed conclusions.

The most adequate study of the subject was made by the President's Mediation Commission in the fall of 1917.¹ Unfortunately no for-ester was called upon to assist in the interpretation of these results. Conditions in the industry from the labor standpoint were summarized by the commission in the following words:

Social conditions have been allowed to grow full of danger to this country. It is these unhealthy social conditions that we find the explanations for the unrest long gathering force, but now sharply brought to our attention by the disastrous effect upon war industries.

Partly the rough pioneer character of the industry, but largely the failure to create a healthy social environment has resulted in the migratory, drifting character of workers. Ninety per cent of those in the camps are described by one of the wisest students of the problem, not inaccurately, as "womanless, voteless, jobless."

The fact is that about ninety per cent of them are unmarried. Their work is most intermittent, the annual labor turnover reaching the extraordinary figure of over 600 per cent. There has been a failure to make these camps communities. It is not to be wondered at then, that in too many of these workers the instinct of workmanship is impaired. They are—or rather have been made—distintegrating forces in society.

Psychologists have shown conclusively that the thwarting or repression of the natural human desires produces maladjustments of the most serious nature in individual human character. Of all repression the thwarting of sex instinct and family relationships has the most serious results. Particular note should therefore be made of the Commission's statement that 90 per cent of the men are unmarried. Compare this with the report of United States Census for 1910 show-

¹ Report of President's Mediation Commission to the President of the United States.

ing marital condition of all males over 15 years of age in the State of Washington, which shows 46.7 per cent of this age class to be married. It is thus evident that one of the most outstanding evils of the transient character of destructive lumbering on labor is the denial of the family life. The average laborer entering this industry inevitably ends his family line. The repression of his normal sex life also in most instances introduces vagaries of various kinds into his character which when combined with a continued sense of injustice, due to the uncertain character of his job, and its attendant conditions, makes his mind fertile ground for freak economic and political theory, to such an extent that masses of men subjected to such conditions are shaking the foundations of organized society.

Due then to the denial of family life, nomadic industry tends to exterminate whatever class of labor engages in it, unless this labor is willing to attempt carrying on the family life in temporary shacks. Thus the old New England stock of lumbermen, unwilling to bring a family into such conditions, has passed for the most part into oblivion. The negro of the South, and the nondescript races now appearing in the camps of the Northwest, may not universally meet such a fate, because they and their families accept low standards of living with but feeble protest. Good citizens cannot be reared under such conditions.

The high percentage of turnover in the industry cannot be charged entirely to destructive lumbering as a policy. However, the policy of exploitation without reforestation contributes directly to this result. Under this policy new tracts are continually being opened up, while cutting on other tracts is continually being completed. Under these conditions the employer has come to feel no responsibility to furnish continuous employment and, indeed, it is usually impossible for him to do so. Continuous forest production, on the other hand, renders continuous employment easily possible where intelligent business management is practiced. The many varieties of work provided by continuous forest production under sustained yield can be made to provide employment in some line continuously.

Neither can the impairment of the instinct of workmanship be entirely charged to the exploitation system of handling forests, but it is a contributing cause. We have only to compare the average conditions in agriculture with those in forest industry to see how much is being missed in the latter as regards pride of workmanship. On the farms we have millions of men planning and carrying out plans for

improvement of the industry. Forest industry will produce like results whenever forests are handled for continuous production instead of destruction. It is repugnant to the nature of civilized man to destroy, and only the desire for immediate gain leads him to do so. Planning and executing plans for permanent development of forests will create pride of workmanship where destruction of forests never can.

We find then under destructive lumbering the following results accrue to labor:

1. Denial, in most cases, of the opportunity for normal family life.
2. Deprivation of most rights of citizenship, especially the right of suffrage.
3. Irregularity of employment.
4. Deprivation of all "stake" in industry and in its management.
5. Continuous feeling of sense of injustice, resulting in many cases, together with above causes, in desire to overthrow the existing institutions of organized society by violence.

These conditions are most dangerous to the community where they occur and to the nation. The question remains whether they are due to destructive lumbering or are essentially part of forest industry. To answer this we may compare conditions in our forest industry with those in the same industry in France and Germany. In those countries where continuous forest production is practiced, it appears that employment is continuous, and the general conditions perhaps better in forest industry than in other industries. They indeed closely approach conditions in agricultural industry, and with it form a firm bulwark, instead of a source of weakness, in the national life.

Is it then only in America that such conditions are necessary? To so affirm is to say that abundance of forest resources is a curse rather than a blessing. It must, of course, be fully obvious to anyone conversant with some of the principles of economics, that the general abundance of resources in America as compared with Europe makes it possible, if intelligence be applied, to handle them on as conservative a basis as public needs may indicate. Continuous forest production on sustained yield basis is not only feasible but there can be no doubt that practicable improvement in conditions of labor which can be made to accompany it, will so improve the spirit and increase productivity of labor as to more than pay any slight increase in costs due to this changed policy in forest management. Early initiation of steps in this direction must not, therefore, be delayed for long.

SHOULD THE COMMITTEE REPORT BE APPROVED?

BY WILLIAM L. HALL

Frankly, I like neither the procedure that has been followed nor the plan proposed. I shall vote "No" on the plan for the following reasons:

That the situation now presented to the Society is large with opportunity is probably understood by every member. If the Society meets the issue it must propose a program that will win public approval both as to its aims and its methods. Its object must be clearly set out and disengaged so far as possible from complicating features. Its methods must accord with the country's best experience and precedents.

The Committee, it seems to me, has not met these requirements. It has not singled out and put in the center of the stage, with the limelight full upon it, *the important problem of keeping timber lands productive*. It has brought in the labor problem and the problem of public control of the lumber industry and linked them all up together. The solution of the forestry problem can only be retarded by the combination. Likewise in the methods proposed the Committee has not followed the line of our most successful experience. Should the Society approve the Committee's report it would become sponsor for a program that I believe has fatal weaknesses and that cannot stand the critical consideration of the public and Congress. Let us examine particularly some of the more important proposals.

WHERE THE PLAN FALLS DOWN

In Proposing a Program of Antagonism.—The Committee proposes to force a National solution for a problem inherently local and State. The forestry problem, so far as it relates to private lands, is a local and State problem just as truly as is the school problem or the road problem. How unwise it would be to try to force either into Federal hands! It is just as unwise to try to force a Federal solution of the forestry problem. Has not the Committee in reality proposed a program of Federal and State antagonism? All the successful precedents are in the direction of employing the authority of the States with the Federal Government a powerful, stimulating, co-ordinating, and co-operating agency. Consider public education, agricultural extension, control of

livestock diseases, road building, forest fire protection. State control with Federal co-operation in every case. Americanism rather than Prussianism is the better way.

In Proposing Control of the Lumber Industry.—We know not what action with respect to the lumber industry may be necessary in the far future. It may all be in public hands; but at present to make the complete control of this enormous industry a part of the forestry plan is not going to help secure the main thing we have in view. It is unnecessary to argue here whether the lumber industry should be under public control. Whether it should or should not, the tying up of a National Forestry Program with that proposal is going to be fatal.

In Trying to Solve the Labor Problem.—That the labor problem as it exists in the lumber industry cries out for solution is not debatable, but the moment we begin to work on the labor problem in the lumber industry, we find it a part of the whole labor problem of the country. The public will insist upon its being so considered, and so will Congress. If the forestry problem has to wait upon the solution of the labor problem, then forestry is doomed. It is a mistake to tie the two together.

In Its Proposed Plan of Organization.—The Committee proposes a commission, consisting of the Secretaries of Agriculture and Labor and the Chairman of the Federal Trade Commission. The commission would have general jurisdiction over the forestry problem and industries. The Forest Service would become the chief instrumentality for carrying the commission's policies into effect. In itself it would have no more authority than it now has and it would become subject, though to what extent is not clear, to the Secretary of Labor and to the Federal Trade Commission. Pity the Forest Service when it begins to serve the three masters!

That the Forest Service is organized on too small a basis for its present great responsibilities is recognized by many, and that it would be wholly unable to cope with the problems of a truly National scheme of forestry is certain. Its foundations will of course have to be made stronger. Merely to make it subservient to three departments, with no more authority than it has now, will not answer the purpose. The plan proposed by the Missoula Section would be far preferable.

In Its Uncertain Constitutional Basis.—The use of private lands under our Government has always been considered a State problem. Forestry, so far as it relates to private lands, is such a problem. It is

difficult to see how, in view of the generally recognized State jurisdiction, it could be maintained that the Federal Government also has jurisdiction. Mr. Woodruff's statement in the last number of the JOURNAL, may well increase one's doubts. He states three possible grounds on which the courts might find a basis for upholding Federal control, but he discloses his own doubt in saying, "If the proposition of your Committee is not workable along constitutional lines, we will perhaps be obliged to ultimately try for a constitutional amendment, as has been done in the case of the income tax, suffrage, and prohibition." His statement is nothing short of startling when he says that if the Supreme Court should find no basis for this legislation its decision would upset the Appalachian National Forest legislation, a contingency he does not want to consider. Neither do I. Any decision which would upset the Appalachian Forest legislation would probably demolish our whole structure of National Forests and necessitate some entirely new basis on which to build our forestry enterprise. Let us take no step that might lead to such a disaster.

My conclusion is that it would be the wisest course to reject these proposals of the plan and then have a committee to revise the plan so as to bring it more fully into accord with American precedents and principles.

PUBLIC ACQUISITION OR CONTROL?

BY E. I. TERRY

If the necessary legislation could be secured I believe that the Pinchot Committee plan for controlling private timberlands would prove more effective than any other so far proposed and I would vote for it in preference to the Forest Service plan. But I do not believe that any plan for the public control of private lands on an extensive scale can ever be effectively or satisfactorily carried out in this country.

I believe that the *main objective* of our forest policy should be of a different character, namely: *The public acquisition of two-thirds of the private timber lands of the country (exclusive of farm woodlots) in a period of forty years.* I do not insist that two-thirds is the exact amount of timber land that should be acquired or that forty years is the correct period of acquisition, but state the objective thus definitely as a concrete illustration. My personal conviction is that two-thirds is the minimum acreage that should be acquired in the shortest practicable time. If after deliberate examination it were deemed feasible to acquire the proposed amount in thirty years or even less, so much the better. But the gradual acquiring of a definite proportion of the private timber lands of the country during a pre-determined period of acquisition should be the objective.

According to the best statistics available there are in round numbers 235 million acres in timber holdings larger than woodlots. One hundred and sixty million acres is slightly more than two-thirds of that amount, and in my opinion might well be set as the minimum for acquisition. Added to the present 100 million acres of public forest land would give a total of 260 million acres in public ownership, or about one-half of the total forest area of the country. That is none too large a percentage to be held in public ownership.

The National Government should be empowered to acquire the land alone, if necessary, but should co-operate with every State that should express its desire and show itself prepared to co-operate in the work. In all such cases, the land acquired within any State could be retained by the State or divided between the State and Federal Government according to a pre-determined agreement. The procedure should be based upon a land classification in each of the principal forest regions,

and the areas to be acquired in each region would be determined therefrom. In deciding upon these areas, due consideration would be given to their value for protective purposes and to their relative situation and extent as affecting an efficient administration of them, as well as to their value for timber supply. The acquisition area having been mapped out for each region, the Federal Government (or Federal Government and States acting conjointly) should then proceed to acquire such land gradually during the acquisition period, exercising the right of eminent domain whenever necessary.

One alternative, however, should be granted the private owner whose land should lie within an acquisition area. Any such owner who should elect and should give satisfactory evidence of his sincerity to manage his land in accordance with good forestry practice should be allowed to retain it at least temporarily or so long as he lived up to his agreement. For the owner (individual or company) to employ a professional forester or staff of foresters and put the management of his timberlands into their hands, would be strong *prima facie* evidence of his good faith. The Government (National or State) would retain the right of inspection, but the private timberland and operations thereon would be handled by the owner's own forestry staff and not by public foresters. I believe that is the only way in which private timberlands should be permanently handled. If any timber lands within a proposed acquisition area are withdrawn from the possibility of public acquisition in this manner, additional areas may be added to it until the total acreage fixed upon for acquisition in that region has been acquired—or until (before that percentage has been acquired) all the forest land in that region has either been included in the public acquisition area or put under private forest management.

Two classes of land should be distinguished for acquisition—land which shall have been cut over and land upon which merchantable timber shall be standing at the beginning of the acquisition period. The aim should be to acquire all or nearly all of the cut-over absolute forest land in each region and reforest it as soon as possible. But the public should not allow the remaining forest to be devastated before acquiring it. Every owner of timberlands lying within the acquisition area, who does not elect to retain the ownership of his land and put it under forest management, should be given two choices as to the manner of disposing of it. He may (1) sell his uncut land to the Government at a price agreed upon by both parties, or (2) the owner will be required to cut his timber at a date (or between certain dates) within the period of acquisition, and must then cut it under public supervision, the timber being marked by Government officials and slash to be disposed of as required. Upon the completion of logging operations the land would be turned over to public ownership at a price mutually agreed upon or set by the Government; due compensation being made to the private owner for the timber that was required to be left standing.

PREVENTION OF FOREST DEVASTATION

BY THEODORE S. WOOLSEY, JR.

Col. Henry S. Graves, the retiring Forester, Forest Service, United States Department of Agriculture, made his greatest contribution to forestry when he began a national campaign against forest devastation. And if State or National legislation, or both, can be secured to control the further destruction of forests, it will be unique in forest history, because usually the evils of forest destruction have been maintained for a longer period than they have in the United States thus far in our history before really effective forest laws could be secured. Let us hope, however, that the United States will excel other great nations in combating the economic influences that tend toward forest destruction, notwithstanding the ultimate cost to the nation.

As yet, there has been no discussion of what the cost will be to the consumer, if our legislation is secured. Practical forestry will, unquestionably, increase the cost of stumpage—costs that eventually will have to be paid by the purchaser. Will this cost be less (*a*) if the public owns a far larger proportion of the forests, as has been proposed, or (*b*) if it subsidizes or forces the private owner to produce timber? Before answering this question I should like to see a clear-cut business statement of what it now costs to manage the National Forests, exclusive of investigative work and other expenditures which may not be chargeable directly to national forest administration, and I should like to see the Forest Service take a lead in condemning instead of countenancing forest destruction. The case I have in mind is the purchase of the Vanderbilt Pisgah Forest, near Asheville, where the National Forest Reservation Commission made arrangements to purchase the soil, *after the forest had been denuded*, instead of before. What a pity that a splendid forest property, conserved for a number of years under a trained forester, should be sacrificed to devastation just before it was to go into the hands of the Federal Government. This has been the prevailing policy, namely, to buy denuded land and not virgin timber. And if the Government can not afford to buy fully stocked forest and manage it conservatively, is it fair to ask the private owner to do so?

We must secure Federal legislation to stop destruction and perhaps allow the States to enforce it *with inspection by Federal officers*, such as is now secured under the Weeks law, with the subsidized fire protection; but to my mind the safest, surest, fairest, and most practical means of securing the results is to recognize that real forestry is not profitable, and that, therefore, the private owner must be subsidized in some way or other, for it is, of course, hopeless to imagine that all forest land can be purchased by the public. Much of it must remain in private hands, and foresters, recognizing this necessity, must plan to secure forestry through the agencies of private owners.

There are a number of points, in connection with this problem, about which foresters and lumbermen disagree. I will comment briefly on some of them.

(1). *Kind of Ownership*.—I believe that even more emphasis should be placed on the necessity of large increases in public ownership.

(2). *Constitutionality*.—It seems to me that the question as to whether Federal legislation will be constitutional or not should, as Mr. Woodruff argues, be left for the courts to decide *after* the legislation is secured.

(3). *State or National Ownership*.—There should be a national law against forest destruction, enforced by State agencies, with inspection by the Federal Government. I can not help but feel, as Mr. Pinchot does, that "Under the plan for State control the public must attack the lumber interests in the lumbering States, where they are strongest; and without the help from the deforested and treeless States, where the sentiment for conservation is most alive. The lumber interests would be fighting in their strongest trenches, the public from its weakest ground." With Federal legislation, State enforcement and Federal inspection, destructive lumbering could be stopped, but since the nation as a whole will benefit from forestry it seems to me that the Federal Treasury should supply the subsidy to the private owners, which, to my mind, is due him to pay for what he loses and for what the public gains. If the problem is left to the States, I fear that very little would be secured. There would be exceptions, of course, but I have in mind what one of the Governors stated to a forester, who was planning a campaign for forestry betterment. The forester was called into the office of the chief executive.

"You have a good position with congenial work and reasonable pay."

"Yes, sir," replied the forester.

"Well, if you want to continue in that position, stop this innovation which you have planned."

(4). *Farm Woodlots*.—I agree most heartily with Colonel Greeley that it is very essential that forestry be practiced on the farm. I see no reason whatsoever for excluding the farmer from the benefits, or dangers if you will, of Federal conservation. The most practical forestry just now in dollars and cents will probably be just the kind of forestry which the farmer can afford to undertake. When our farmers are convinced of the practicability and desirability of forestry, they will prove a tremendous force in securing improvements and benefits in legislation, when that becomes necessary.

(5). *Industrial Essentials Should Not Be Linked*.—Here again I feel that Colonel Greeley is right and that these essentials should not be linked with the movement against forest destruction.

(6). *Subsidy*.—Why should a subsidy not be granted? It will unquestionably cost the private owner money to follow out the kind of beneficial Federal legislation, which we hope to secure. Should he not be compensated, and should not the public, who gains, pay for what it secures? To my mind foresters are unfair when they fail to recognize that just compensation is due the private owner. With Federal legislation and the consequent power of checking the work by State agencies, the danger of graft in subsidies would be minimized.

I can not help but feel that the best plan for the lumbermen is to boost rather than to fight the campaign for forestry in the United States. Our national economical supremacy is largely due to our wealth in national resources. Our forests are one of our most important storehouses of raw products, and why should they be destroyed and the soil laid waste when the very nation itself will sooner or later reap the harvest of profligacy?

THE FOREST INDUSTRIES AND THE INCOME TAX

BY CARL M. STEVENS

The work of the Timber Section of the Bureau of Internal Revenue has a great deal of interest for foresters because it is concerned exclusively with the forest industries and because it considers and continually studies the basic economic factors which control those industries. Though the Timber Section is in its infancy and is just coming to a full appreciation of its own problems, the work has developed sufficiently to form a background for its larger work. The manner in which the preliminary work has been carried on is particularly worthy of close study, as indicative not only of a careful and thoughtful plan, but one which has in it the true elements of the function of a representative government.

The Timber Section is entrusted with the administration of the Federal income and excess profits taxes as they affect the forest industries. These industries require special consideration because there are particular provisions in the law applicable to them. Being assigned its work thus definitely by law the section starts and completes its activities within the bounds of a certain clear-cut field. Thoughts back of the law are beyond its province.

Only a few years ago very few of us, comparatively, knew there was such a thing as an income tax and those few did not know it from personal experience. It is usually helpful to form first an historical background for a consideration of present-day affairs. There are, too, certain fundamental governmental functions which it is well to recall. This is especially important when we stop to think that before income taxation could be adopted by the Federal Government of the United States an amendment to the Constitution was required.

The United States Federal Government is a government of limited powers; that is, each State of the federation is a sovereign government by itself limited only by the Federal Constitution. All governmental functions which are not expressly granted by the Constitution to the Federal Government are inherent in the States.

Among other things the Federal Government has been granted the power to tax in a very vital way. There is only one exception to this power and there are only two qualifications. The exception is that

exports may not be taxed. The first qualification is that direct taxes must be levied in accordance with the rule of apportionment; that is, levied on the States in proportion to their respective populations. The second qualification insists that an indirect tax must be levied uniformly over the industry or industries to which it applies.

Federal revenue is derived from two general sources. There are first the import or customs duties and secondly, internal revenue. Broadly speaking, internal revenue includes all receipts of the Government including miscellaneous receipts as well as internal taxes. The Bureau of Internal Revenue is concerned, however, only with the latter.

Internal taxes are of two kinds. Direct taxes are those which attach to property by reason of ownership. Indirect taxes do not attach by reason of ownership but may attach by reason of some function. Examples of the latter are excise, stamp, and income taxes.

An income tax act was passed by the Federal Government during the Civil War. This act was in force for several years. The next act was passed in 1894. This act was immediately attacked in the courts as unconstitutional. It was a tax on the income from real estate and property and said to be for that reason in effect a direct tax on the property. Since it was not apportioned in accordance with the population of the various States, it was held to be unconstitutional and was so declared by the courts.

In 1909 Congress passed an act in the form of a privilege tax on corporations. This act was held by the courts to be a true excise tax, and stayed in effect. The actual levy was a one per cent assessment on the income of the corporation and as a result only a small revenue was received.

On February 25, 1913, the sixteenth amendment to the Federal Constitution, providing for the direct taxation of incomes, became effective. Later in that same year, an act taxing the incomes of both corporations and individuals was passed. Purely as a matter of convenience, Congress chose the first day of the month following the constitutional amendment as the transition date between the excise tax then in effect and the new income tax law. March 1, 1913, became by this means one of the critical dates in Federal income taxation in the United States. For a number of years after that this law prevailed but, with the same low rate of taxation, and with a high specific exemption the returns were not large.

In the year 1916 the income tax was doubled in percentage. It was still very low, however, only two per cent, and everyone paid the tax and let it go at that. This increase was occasioned by the decrease in revenue from other sources. About this time the tax revenue from liquors besides other items declined.

Now we have come to the year 1917 and what that meant to the nation. The United States declared war on the Imperial German Government and went as completely at that conflict as it came gloriously through it. This meant great expenditure of funds on the part of the Government, and we came late in the year 1917 to a sharp increase in Federal taxes; to a really heavy income tax rate. Not only was the rate of income taxes increased, but the excess profits tax was added. There was at this time a marked reduction of exemption allowance to both individuals and corporations.

Following this, we have what is known as the Revenue Act of 1918. This act prescribes the tax for the year just passed and the present year. These are also really heavy tax years, and we know, too, that heavy tax years are to follow, even though we are not quite sure just what particular form the tax program will take.

Perhaps the history of what these taxes really mean and what they accomplish is best illustrated by a few figures. In the year 1914 income taxes amounted to less than 61 million dollars. They made up approximately fifteen per cent of the Internal Revenue collections. In the year 1918, however, income taxes amounted to almost 3,000 million dollars and they made up approximately eighty per cent of the Internal Revenue collections.

All this has placed the Bureau of Internal Revenue squarely against one of the largest tasks of its kind in the world. It has been necessary to increase the force very materially and a complete reorganization of the Bureau in its several subdivisions and sections has been required. All of this takes time because it is first necessary to be reasonably sure that the organization which is put into effect will be able to satisfactorily redeem its responsibility.

The Bureau of Internal Revenue has not only been assigned the task of collecting the tax, but has been furnished ample authority and power. It is the duty of the Collector of Internal Revenue, in case an assessed tax is not paid, to secure a distraint warrant for any property and sell it. A distraint warrant is the equivalent of execution on a judgment. If the tax has been erroneously assessed and collected, claim for recovery may be made and after a lapse of six months suit brought.

Even by suit, however, there is no redress beyond the amount actually realized by the sale.

Rather than follow drastic procedure of this kind, however, the Bureau aims solely at a just, impartial enforcement of the law. It is the intention to collect all of the taxes due but only such as are due. It is the constant aim to disturb business as little as may be possible and be careful to see that complete equity is secured between industries and between different firms and members of the same industry. In the furtherance of this idea, the Bureau has called freely upon the industrial and legal world for advice and assistance.

Back in the early days when the excise and later direct taxes were light, no one bothered about them very much. They annoyed, perhaps, but did not hurt. Inequities and inequalities there were, and they troubled a bit, but one gained more by forgetting these and applying himself more assiduously to his business. The country came suddenly, in the year 1917, and sharply, too, against a real wall. The tax rate of necessity had jumped and the sharp rise forced attention abruptly to it.

The vast taxes which the American people have been called upon to pay have been burdensome. This burden has, however, been gladly met. Lumbermen in general are practical, hardworking pioneers. They are too prone, perhaps, to pay attention to the field features of their business, at the expense of office work and accounting methods. Generally speaking, the lumber industry, because it has been lax in its accounting, has been a little more severely hit by the tax than it otherwise might have. They ask, however, with the rest of American business, only that each individual and each separate industry receive the same fair and impartial treatment. A single evasion or an incomplete understanding resulting in an inequitable consideration of an industry means merely that their share of the burden must be shifted to other shoulders.

The difficulty encountered in administering these heavy tax laws was particularly greivous in dealing with the so-called wasting industries; that is, mines, oil and gas, and timber. These are all very similar to a degree, and yet there are material differences. They are alike in that they deal with a present capital asset which is exhaustible. They are alike in that they are concerned with a natural resource and that the conversion into a useful product is a particularly hazardous enterprise. The essential differences, however, are as fully apparent as the items of similarity. Timber is a crop, grown on top of the ground. It is the

same kind of a crop whether it be reproduced from natural sources or artificially planted. Mines, oil and gas are natural deposits, usually within the ground. They are subject to discovery and by the very nature of their location, uncertain. Were it not for the fact that we found on coming to this country what appeared to be almost inexhaustible supplies of timber, the similarity between these different classes of natural resources would not be as marked.

The Federal income tax laws provide in the case of these wasting industries that as the capital assets are used up in the course of operation a depletion charge may be claimed as return of capital. This depletion is not reported as income and no tax is paid on it. The early revenue laws in this country and the regulations of the bureau insisted that this return of capital be made on the basis of the actual cost of the assets, regardless of the time of purchase. This position was contested in the Supreme Court, and was finally settled by the epoch-making Doyle-Mitchell decision. It was decided proper that for timber a capital returnable through depletion should be based on values rather than cost. This decision was made because otherwise what purport to be income taxes would be made to apply to property. The actual value of the property owned by a taxpayer at the time the income tax laws were put in effect was declared to be property and not income.

This factor having been decided and recognized by law, the Bureau of Internal Revenue was faced by an immense valuation problem. Not only were great quantities of timber in the United States in private ownership when the income tax laws were promulgated but immense bodies of ore, gas and oil as well. Since Congress had chosen March 1, 1913, as the real starting point for income taxation in the United States, this became the really critical date from a valuation point of view.

The development of the work from this on is a lesson well worthy of careful thought. The Bureau was faced by an immense problem with industries which were not even of a similar mind among themselves. A solution was necessary and too great delay could not, in fairness to the country at large, be permitted. It was possible for the Bureau to proceed arbitrarily, establishing values and assessing taxes in the light of its best knowledge and belief, leaving the final settlement to the slow process of the courts in each case. Instead of which its policy of seeking industrial advice was followed. Acting the Bureau formed about a year ago a section which was concerned upon the suggestion of the industries, in an openly co-operative spirit,

particularly with mines and with oil and gas. Early in the summer of 1919, a parallel section for the general forest industries was formed. The organization of this section was initiated largely at the instance of the lumber industry and it has been developed closely in co-operation with it. These two sections are now grouped in the Bureau of Internal Revenue in the Natural Resources subdivision.

The exact manner in which the timber section was organized and the way in which the work has been carried on is still indicative of a continued open-minded approach and co-operative solution of all problems. Late in April, 1919, Major David T. Mason was called to Washington and requested to organize the Timber Section. The plan of work and general superintendence over this kind of business has been left largely to him. The Timber Section has enjoyed the greatest freedom of action and its suggestions have been received in an entirely open-minded manner. The section is then, in turn, held as completely responsible for the entire action.

By this means the Timber Section itself came to the problem with full authority to carry out the work as it saw fit and with as full responsibility for the proper redemption of its authority. It could proceed, in turn, in the light of its present best knowledge and belief or could continue to gather to it such thought and enlightenment as might best help. The latter course was chosen for the obvious but too little recognized reason that no one might be expected to know as much of the industry as those immediately and constantly in contact with its problems. Each step which the Timber Section takes has brought to it all of the thought which can reasonably be brought to bear. The industry is constantly in close touch with the work and is requested to co-operate in it by means of constructive suggestion. These suggestions are received in an open-minded manner and acted upon when well founded. In cases where suggestions cannot be acted upon an effort at reconciliation, in order that the reasons why they cannot be followed may be clear, is attempted. So far, these efforts have been almost universally accepted, and the industry has been found as clearly open-minded and aware of the problems of the Timber Section as it, in turn, is of theirs.

The organization of the Timber Section at the present time contemplates the division of the United States into typical timber regions. It is the intention to have in Washington a valuation engineer for each of these regions, a man who is thoroughly versed in the lumber industry, and is familiar with timber and plant values. This man is given

the same sort of freedom of action and is in turn held directly responsible for the proper valuation of the forest resources of his region.

Early in the work of the Timber Section it became clear that for an intelligent audit of income tax returns and for an equitable valuation of property for tax purposes it would be necessary to have considerably more data available. In other words, in order to give the individual taxpayer in the industry an opportunity to present the complete details which concern his particular case some working medium must be established. Obviously, since the Bureau deals with individual and specific cases, general data could be used only in part. It was decided necessary, therefore, to issue an individual questionnaire. The problem which confronted the section was the compilation of a series of questions which would secure the fullest amount of information for the purposes aimed at and the same time be the smallest burden for each taxpayer concerned.

The record presented must be complete enough to thoroughly present the facts in each case clearly. Even though the regional valuation engineer should become thoroughly enough acquainted with his region to feel sure of his ground it is natural that his decision should be questioned unless substantiated by written fact. Then, too, it cannot be expected that one regional man may be retained indefinitely, and it is necessary to have available not only the sort of data which would substantiate his views, but the sort of data which another would compile to the same result.

Even though it seemed clear to the members of the Timber Section that a questionnaire would be required it was considered best to check this judgment in conference with the industry itself. With this in mind, a tentative draft of a proposed questionnaire was discussed at a meeting in Chicago, with about forty representatives of the industry, including the members of the Economics Bureau of the National Lumber Manufacturers' Association. This meeting was followed later by a similar discussion in New York with about twenty representatives of the industry in that region. It was the sense of each of these meetings that a questionnaire somewhat similar to the tentative draft which had been presented would be needed. It was agreed, however, that the draft in its present tentative form was not entirely adequate to the respective needs of the industry and the Bureau of Internal Revenue.

In response to an invitation issued by the Bureau, a committee of seventeen duly appointed association representatives, together with fifteen other individual lumbermen, met at Washington for a ten days'

conference with the Bureau officials. During the conference the proposed questionnaire was studied thoroughly and discussed in all its phases. Many suggestions of a constructive nature were made and many were adopted by the Timber Section. A choice was made in selecting questions for inclusion and the use of the material weighed against the effort which it would take to get it. The result it is felt because of this advice and help is in particularly good form to serve the end for which it is intended.

This spirit of co-operation has been retained throughout the entire program of work so far. Representatives of the Bureau met the industry in an itinerary of eighteen formal meetings scattered over the entire country. The purpose of these meetings was an explanation of the questionnaire. The Bureau representatives were present at these meetings at the invitation of the forest industries taxpayers of the various regions.

These more or less formal meetings were supplemented by the issuance of a schedule which established conference stations over the country for the various regional valuation engineers. The engineers were stationed for various stated periods in offices to be available for consultation by the taxpayers on their particular problems. These regional men have also attended various smaller informal meetings of the industry where any and all questions are freely discussed. Any attempt at a description of the questionnaire itself would be a long and entirely different story. Briefly, it provides the data necessary for a substantiation of the depletion claimed on account of timber removal. Depletion is claimed on the basis of the value of timber as of March 1, 1913, if owned on that date, or cost if acquired subsequently. Next, it is aimed at a substantiation of the depreciation claimed on manufacturing plants and other equipment. There are some other minor items which tempered the questionnaire to some extent, for it is to be used not only for value determination, but in connection with the audit of income tax returns.

A period of approximately three months was given each taxpayer for a completion of his questionnaire. During practically this entire time the whole personnel of the Timber Section has been available to the taxpayers of the industry to assist them in its preparation. The Bureau employees at the same time are materially benefited by this intimate discussion of each taxpayer's circumstances.

Not only is it extremely important that complete equity be secured in the audit of income tax returns, but it is essential also to secure finality. This latter is especially important in order that American business may know just where it stands; may have an unchanging base from which to work. Heavy taxes are a burden at best. If any great degree of uncertainty is added to this the situation becomes particularly onerous. It is hoped to stabilize the situation by use of the information collected by the questionnaire and with this in mind, the Timber Section has approached the work with mind unprejudiced. It is engaged in an entirely open-minded study of all the problems involved. The solutions are yet to be reached by a study of the actual facts in each circumstance.

All this is of particular interest to foresters because it deals with the basic economic factors which control the forest industries, and in turn, control the present and future of American forest growth. The compilation of facts concerning the industry which is now being made should certainly answer many of the questions which have previously been held in dispute. It is true, of course, that the Timber Section is a part of the Bureau of Internal Revenue and as such concerned only with the collection of data for the administration of existing income tax laws. The industry itself, however, will have the facts for such future compilation as it may see fit to make.

STANDING TIMBER INSURANCE

By W. R. BROWN

The idea of insurance on standing timber grew out of observations and records obtained after six years of fire protection in the United States. In the years before adequate fire protection to timberlands by Federal, State and private associations was afforded, there had been a disinclination to consider standing timber an insurable, due to the lack of means for apprehending and extinguishing incipient fires or combatting larger ones. After six years of fire protection carried on by over thirty private associations, fifteen State departments and the Forest Service of the Federal Government, with the co-operative assistance of towns, railroads and other agencies, data was collected and combined to show the character of stands burned over, the extent and frequency of fire occurrence, situations most exposed, and total values destroyed in relation to the total value of all timber in the region. These data showed the average yearly loss in value over widely separated areas, as the Pacific Northwest, Quebec forest region, New England States, and the Michigan-Wisconsin region, to be below one-half of one per cent annually, which compared favorably with the loss by fire in all other forms of property.

Presuming that the cost of management would also not much exceed one-half of 1 per cent yearly—the usual average cost of doing business in insurance companies—the possibility of giving protection to their woodlands was seriously considered in the winter of 1917 by a group of New Hampshire timberland owners. The various forms of commercial, mutual, and interinsurance organizations were studied, and it was decided that the mutual form was the most desirable to meet the State laws of New Hampshire and give the greatest latitude for organization. A bill was introduced and passed by the New Hampshire Legislature of 1917 to authorize the incorporation of the Timber Lands Mutual Fire Insurance Company of Concord, the first company of its kind organized in the United States, for the purpose of effecting insurance of standing timber against loss and damage by fire, lightning or other destructive elements or causes. The interest and goodwill of the insurance commissioner was secured and his requirement of \$50,-

000 guarantee reserve was met by subscriptions among the incorporators and directors. The directors were Everett E. Amey, of the International Paper Co.; Martin A. Brown, of the Parker & Young Co.; W. R. Brown, of the Brown Co.; Geo. B. Leighton, of the New Hampshire Forestry Commission; H. G. Philbrook, of the Connecticut Valley Lumber Co.; E. Bertram Pike, of the Pike Manufacturing Co.; L. S. Tainter, of the Publishers' Paper Co.; C. C. Wilson, of the Odell Manufacturing Co.; and George Hewitt Myers, a forester of Washington, D. C. W. R. Brown was elected president; Everett E. Amey, vice-president; S. L. de Carteret, treasurer and manager; and Thomas E. Sears, of the insurance company of Ives, Baird & Sears, Boston, secretary.

A form of policy was adopted which provided for additional security through the pledging of the policy holder to meet a loss if called on to the amount of twice his annual premium. The company was authorized to write a line in New Hampshire to the extent of \$5,000 at 2 per cent annual premium on a mutual basis, it being understood that the policy holders retained their rights and interests in any unexpended balances there might be at the end of the year, when used to build up a reserve. The policy also bound the policy holder by a co-insurance clause to an approximately correct estimate and valuation of his stand to within 10 per cent, so that beyond 110 per cent or under 90 per cent of true value he would be the co-loser with the company in a damage settlement in the proportion that the amount he over or under valued his stand bore to the actual amount found existent by careful estimate and appraisal made after the fire.

The general principle followed was to scatter the risks widely throughout the State, to make them small if for full value or take but a partial risk over a large area, and to have these risks at least one-half mile apart in a wooded area or separated by some natural fire line, as a farm, lake, sizable river, clearing, etc. Any policy holder who wished to receive more insurance on his timber than represented by \$5,000 could be accommodated by an arrangement made with the Globe-Rutgers Fire Insurance Company of New York, an old-line stock insurance company of size and resources, to take the additional risk at approximately the same rate, but on this insurance there was no return of unused premium at the close of the year.

Estimates and values were determined on the basis of a written statement, copy of which is attached, filed by the policy holder with the

company. If plantations or unmerchantable young growth of natural reproduction, a predetermined valuation per acre was agreed upon as the basis of loss settlement. If second cuttings or old growth, the statement supposedly represented a fair market stumpage estimate and value of the full amount of merchantable and accessible softwoods and hardwoods on the land, large enough to make pulp or lumber, and did not include land values in any way or young growth too small to be merchantable. Final settlement was made on the actual value of the timber destroyed, as found by the company's adjuster, with the co-insurance clause working as described above. In case of a dispute over the salvage value of timber left, the company reserved the right to pay the value of the lot as set in the policy and salvage for its own account. The regular standard policy of insurance authorized in New Hampshire was used, with a rider concerning the special clauses applicable to timber insurance. A higher premium charge was required for a policy taken out only for the dry season, or for carrying over the dry season when canceled at the close of it. Insurance was written in Vermont and Massachusetts only upon solicitation from those States, as the company had no right to solicit outside of New Hampshire. During the first season insurance was written to an amount of \$276,000, no risk exceeding \$5,000 in 57 towns in New Hampshire, Massachusetts, and Vermont among 62 policy holders, 87.4 per cent of which was merchantable timber, 4.2 per cent plantation, and 8.4 per cent young growth. Care was exercised in the acceptance of risks and avoidance was made of land close to railroad right of way, recent slash, portable mills, picnic grounds, large cities, and other unfavorable environments. Cutting or the establishment of portable mills upon an insured lot vitiated the policy unless special permits for same were secured in advance. During the life of the company, which extended for two years, the largest loss sustained was \$600, which occurred in a young plantation completely destroyed.

Due to the war, the solicitation of insurance was given up in 1918 and the company effected reinsurance with the Globe-Rutgers Fire Insurance Company of New York at a rate which left it a small balance for management. At the close of the first year premiums were reduced to $1\frac{3}{4}$ per cent and a further reduction of $\frac{1}{4}$ per cent was in contemplation when the company, having established the principle of timberland insurance and not being particularly interested in the commercial aspect of the matter, decided to turn over its policies to the

Globe-Rutgers Company, who were willing to assume the same rates and agreements and offered a larger line to the policy holders, adequately secured by capital and reserve. At the final wind-up, the guaranteed capital was returned to the directors with 5 per cent yearly interest for the two years.

The profession of forest actuary had necessarily to be created, and the company's manager, S. L. de Carteret, C.E., and his assistant, Victor Beede, M.F., collected considerable data concerning the relative danger in various sites and from various causes, and the losses in old growth, second cuttings and plantations. Old growth proved the best risk, both on account of its resistance to the spread of fire and the usual care that was taken of it, and on account of the large salvage return possible by prompt logging, if in reasonable proximity to market. Complete loss was rare, the fire commonly did not consume the whole tree, but merely ate into the base, often hardly penetrated the bark higher up the bole. Second cuttings were found to be more dangerous on account of the large amount of slash commonly present and the prevalence of immature trees that constituted a complete loss when burned. Because of its low value this land was less often adequately protected, but the loss when it burned was correspondingly low. Plantations were the greatest risk, being subject to complete destruction by slight fire. Plantation values per acre being largely labor, it was necessary that they be agreed on in advance between the policy owner and the company. In actual practice in the future varying rates should be charged, based on the relative risk of each particular piece insured, according to actuarial tables which are not now in existence. Such tables could be constructed by combining the accumulated experience gathered by all insurance companies doing this line of business. The profession of timber insurance actuary should be created and at least one such expert maintained as an adjunct to general fire insurance companies, such actuary having previous practical experience as a timber cruiser, estimator, surveyor, operator and trader.

The following conclusions are based on experience gathered:

(1) A mutual timberland fire insurance company, to be organized safely, should be on a very large scale, with ample funds behind it, and should extend its insurance over wide areas in order to get an average risk. Risks should not be written unless there exists ample protection against fire afforded by State and town or the owner himself, over the area to be insured.

(2) The expense of preliminary estimate and valuation of small lots of land is prohibitive in view of the small premium received. With the co-insurance clause inserted it is safe to take the members' own returns as to amounts and value as correct, and when a number of adjacent risks have been secured, they can be passed upon by the manager in one trip rather than many.

(3) A very large capital reserve is required by law to enable a company to obtain a charter to write freely a considerable line in all States and secure the advantage of covering a wide area and the average risk. The National Lumber Manufacturers' Association might possibly do this if general co-operation by large timberland owners could be obtained. Old line commercial insurance companies, however, who have a well-established business and large reserves are in a particularly desirable position to take on this new line of insurance if they distribute their risks wisely, secure sufficient volume, and charge appropriate varying rates based on previously ascertained tables. If it were possible to secure unlimited backing at the start by the creation of a Federal Timberland Insurance Department at Washington as an adjunct of the Forest Service, with the Government's assurance behind it, it is my opinion that an annual premium of one-half of 1 per cent on policies written over all States and on selected risks would more than pay all losses, and if the management was carried on as an integral part of the Forest Service, in connection with its other duties, and little charge made therefor, a sufficiently low annual rate could be offered timberland owners to attract the large as well as the small, and secure the average risk. The effect of insurance on the practice of forestry and the conservative management of timberlands cannot be overestimated.

(4) A standard expenditure for fire protection must be insisted upon absolutely wherever fire insurance is carried. In New England 1 cent per acre per year seems to be satisfactory; in the Province of Quebec, where vast areas are uninhabited from one-quarter to one-half cent proves sufficient; in the Middle Western States 2 or 3 cents per acre is the practice; and in the far West, where values per acre are high, as much as 5 or 6 cents per acre is often required. New England offers the most security on account of the character of the climate, species and soil, and the farm and other natural barriers that cut the timberland up into blocks and make the danger of a widespread conflagration small. In proportion to values the New England States and associations assess themselves the most for fire protection.

(5) Fire protection might well be made obligatory by law upon all timberland owners within a State, under some State co-operative plan, as the small owner is equally a risk to his large neighbor, but does not commonly contribute. Fire protection should not be done by insurance companies on account of their possible legal liability in case of loss for want of furnishing sufficient protection. Insurance companies should withdraw their insurance if their preventive and protective requirements are not lived up to.

(6) The cost of fire protection should be borne by the public as well as the owner, as the causes are often natural, like lightning, and the loss in conflagration affects not only the owner and the industry, but all other industries in the State and serves to depreciate the wealth of the State in general.

(7) Hurricane, insect or fungus devastation should not be included in a policy until statistics sufficient to cover the risk have been gathered.

(8) Comparison of statistics concerning timber loss from fire should be commenced at once by an actuarial board, with members from various sections of the country, to correlate experience gathered, such board to meet either at Washington or at a place designated by the interested fire insurance companies.

Timberland insurance appeals to owners of timberlands one-half to two-thirds grown, who have escaped fire on their timber up to a point where it is near fruition, and who feel they can afford to pay for a few years' insurance even at a relatively high rate until such time as the timber becomes fully developed. They consider they have cashed in a long-awaited investment when they sign an insurance policy, as the danger of complete loss of their investment in unsalvagable immature timber has been removed, and if it matures they will reap its value anyway, and can afford the few years' premium costs. It is doubtful if complete insurance can be carried on plantations, unless the timber values are very great, as the insurance rate eats up a considerable percentage of the growth. Where plantations are necessary for water-works, windbreaks, etc., it may be wise to keep them protected by insurance.

Timberland insurance appeals to farmers who wish to borrow money on timber lots, bankers universally granting loans more readily if an insurance policy is deposited with them. In this way a large amount of capital can be liquidated and put to work to earn more than the one

or one and one-half percent which it will cost to write the insurance. In other words, an insurance company acts as a bond house for the small timberland owner who cannot afford the cost of regularly bonding his property, and for this reason alone it is of great economic value to the country. Timberland insurance also appeals to owners who wish to leave an estate in trust for their children.

Large timberland owners are attracted by insurance only at a very low rate, as their holdings are commonly so widely distributed as to insure themselves to a certain extent. If large holders could be brought to insure together, the size of their premiums would no doubt enable old line insurance companies to give them a much reduced rate on account of the volume of the business, and because when combined they would represent the average rate over the whole region.

Timber insurance offers a new profession to the forester, and as soon as possible should be taught as a part of his course. It has a field for exploitation before it fifth among all forms of property in the United States, hitherto not covered by insurance against fire.

TIMBER LANDS MUTUAL FIRE INSURANCE COMPANY

PORTSMOUTH, NEW HAMPSHIRE

APPLICATION FOR INSURANCE ON STANDING TIMBER

(Where Tracts are Separated, use one blank for each tract.)

1. Name of Applicant.....
2. Address:
3. Location of Timber: State.....; County.....
Town.....; Range.....; Lot No.....
4. Timbered Area..... acres.
5. ESTIMATE OF TIMBER TO BE INSURED:—
(a).....Acres of merchantable green standing timber of six (6) inches or greater diameter at four and one-half (4½) feet from the ground.

KINDS OF TIMBER	1,000 FEET B.M. OR CORDS	VALUE PER 1,000 FEET OR PER CORD	TOTAL VALUE \$	AMOUNT INSURANCE DESIRED
TOTALS				
(b).....	Acres of planted land.			

KINDS OF TREES	ACRES	NO. TREES PER ACRE	YEAR PLANTED	VALUE GROWTH PER ACRE	TOTAL VALUE \$	AMOUNT INSURANCE DESIRED
TOTALS						
(c).....	Acres of young growth, natural reproduction on sprout land.					

KINDS OF TREES	ACRES	NO. TREES PER ACRE (APPROX.)	AVERAGE DIAMETER INCHES	VALUE GROWTH PER ACRE	TOTAL VALUE \$	AMOUNT INSURANCE DESIRED
TOTALS						

6. TOTAL AMOUNT OF INSURANCE DESIRED ON THE ABOVE TRACT \$.....
7. Have there been any logging operations on this tract during the past 5 years?.....
 Dates?..... Were tops and branches disposed of?.....
 How?
8. Will any part of this tract be logged during the next 12 months?.....
 During what months?.....
9. Have there been any fires on this tract during the past 5 years? (Give dates, causes,
 kind of growth damaged and amount of loss in dollars for each fire).....
10. Is this tract regularly patrolled by a fire warden?..... By any of your employees?.....
 Between what dates?..... Who is directly responsible for maintenance of
 patrol and fighting fire should it occur on this tract?.....
11. How far is this tract from the nearest railroad?.....
12. Do you or any of your employees or other responsible persons reside on this tract?.....
13. Is this tract frequented by hunters, fishermen or campers?.....
14. Is there any recent slashing or other extraordinary fire hazard on the lands immediately
 adjoining this tract? (Give details).....
15. Is there an authentic cruise and plan of this tract?.....
16. Loss, if any, payable to whom?.....
 Signature, 19....
 Date.....

It is understood that this Company assumes no liability for losses upon these tracts until the said Company shall have actually issued a policy or policies in accordance therewith or shall have notified the applicant in writing that his risks are accepted.

IF POSSIBLE MAKE SKETCH PLAN BELOW OR ON SEPARATE SHEET SHOWING THE FOLLOWING:—

General shape and dimensions of tract.

Area of standing timber.

Area of plantations.

Area of young growth, natural reproduction.

Area totally or partially cut during the past five years.

Area burned over during the past five years.

Area of cleared land.

Location of buildings, roads and fire lines.

Public roads adjoining or passing through tract.

Whether adjoining land is in timber, plantation, young growth, cleared, cut over or burned.

Locations of railroads if within two miles of tract.

THE JONSON "ABSOLUTE FORM QUOTIENT" AS AN EXPRESSION OF TAPER

By H. CLAUGHTON-WALLIN, *Dominion Forestry Branch, Ottawa, Ontario*, and F. McVICKER, *British Columbia Forest Branch, Victoria, B. C.*

In an article published in the JOURNAL OF FORESTRY, Volume XVI, No. 5, May, 1918, one of the above writers gives an account of the investigations carried on by the Swedish Forester, Professor Tor Jonson, with reference to the stemform of Norway spruce and Scotch pine.

To express the variation in stemform or taper, Jonson uses a new formula, the "absolute form quotient," $q = \frac{d}{D}$ where "d" is the diameter at the middle of the stem *above breast height*, and D is the diameter *at breast height*. This formula differs from Schiffel's form-quotient in that "d" in Schiffel's formula is situated at the half total height of the tree. The advantage of Jonson's method in expressing the variation in form which is fully explained in the above mentioned article is that the classification is made independent of height, the two form-determining diameters always being in the same relation to each other. Schiffel and others have shown that trees with the same form quotient and equal height taper according to a fixed law. Jonson claims that taper of trees of the same absolute form quotient or "form class" is also independent of height if the measurements are taken at proportional places or as Jonson states in his articles on the stemform of Norway spruce: "The percentic taper is the same in all 'normal' spruce of the same formclass, notwithstanding differences in height and diameter. A large tree is developed exactly as a small tree, providing both have the same absolute form quotient."

After having reached the same conclusion in regard to Scotch pine, Jonson generalizes Hoejer's formula for the stem curve and uses it to calculate the taper for each form class, finding, as is shown in the above mentioned article in the JOURNAL OF FORESTRY, that the mathematical formula shows complete conformity with nature. Taper and volume tables are then constructed. L. Mattson-Marn of the Swedish Institute of Experimental Forestry, has carried on the investigation on larch. He finds that scarcely any difference is to be observed between the taper

series obtained from this species and those which were earlier worked out by Professor Jonson for Scotch pine and spruce. He also finds that the volume tables drawn up by Jonson and applicable to pine and Norway spruce, can be used with reasonable accuracy in the valuation of larch.

It is obvious that much time, money, and energy which is now being spent on the preparation of local volume tables would be saved if we could prove that the "absolute form quotient" when applied to conifers on this continent has the same indisputable value as a form-determining factor as in Scandinavian and that a distinct and constant average taper series, based on actual measurements, can be constructed for each form class. For, having the taper series for each form class and each species, it will only be a matter of office calculations to prepare universal volume tables in board feet, cubic feet or ties for total length or merchantable length, whichever we may desire.

The authors have for some time pursued investigations on this line in Ontario and British Columbia. The results are in our opinion very striking.

INVESTIGATIONS IN ONTARIO

The taper series for each analyzed tree was obtained by dividing the diameter at breast height into the measured diameters at every tenth of the stem above breast height. Consequently, the quotients represented proportionally the same height on all trees, that is, at breast height and at 10, 20, 30, 40, 50, 60, 70, 80, and 90 per cent of the stem above breast height. In addition the diameter at the stump or 3.5 feet below breast height was divided into the breast height diameter. The quotient at half the stem above breast height, or at 50 per cent, represents the "absolute form quotient" or the "formclass."

Grouping all individual series according to form class, the following average series were obtained inside bark.

Red Pine—Form Class 65—Average, 11 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>Red pine</i>	100	94.0	87.6	80.7	73.8	65.0	55.7	43.9	31.0	16.0
<i>Scotch pine</i>										
Jonson's computed series	100	94.3	88.	81.1	73.5	65.0	55.4	44.3	31.1	15.0

Variation in per cent	—0.3	—0.4	—0.4	+0.3		+0.3	+0.6	—0.1	+1.0
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Formfactors according to formula

$$F = \frac{\frac{1}{2}D^2 + d^2 + d_2^2 + d_3^2 + \dots + d_g^2}{10 D^2}$$

(Where D = 100) for red pine 0.439; for Scotch pine —0.441.

Average age of the 11 trees is 41 years.

Average height, 45 feet.

Average d. b. h., 7.9 inches.

Red Pine—Form Class 70.3—Average of 30 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>Red pine</i>	100	94.9	89.9	84.2	78.1	70.3	61.4	49.6	35.	19.
<i>Scotch pine</i> computed series	100	95.3	90.1	84.3	77.7	70.3	61.4	50.9	37.6	19.7
Variation in per cent		0.4	—0.2	—0.1	+0.4		±0	—1.3	—2.6	—1.7

Absolute formfactors, red pine 0.480, Scotch pine 0.484.

Average age of trees is 41 years.

Average height, 48 feet.

Average d. b. h., 7 inches.

Red Pine—Form Class 74.4—Average of 40 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>Red pine</i>	100	95.5	91.5	86.6	81.4	74.4	66.	54.7	39.1	21.2
<i>Scotch pine</i> computed series	100	96.1	91.7	86.6	81.	74.4	66.6	56.8	43.9	24.8
Variation in per cent		—0.6	—0.2	±0	+0.4	....	—0.6	—2.1	—4.8	—3.6

Absolute formfactor, red pine 0.515; Scotch pine 0.524.

Average age, 44 years.

Average height, 48 feet.

Average d. b. h., 6 inches.

The difference in absolute form factors is of course due to the divergence between the red pine taper series and the mathematically computed Scotch pine series in the top sections. Jonson's experience was that his series derived from actual measurements nearly always fell somewhat short of the mathematically computed series in the top sections. This, he believes to be due to the fact that the majority of the trees examined by him were young or medium aged and had not yet

had time to fill up in the top portions. The absolute form factor for form class, 0.744, according to Jonson's measured series, is 0.519, as compared with 0.524 from the computed series.

Red Pine—Form Class 79.5.

Only seven trees belonging to this form class were analyzed. These trees were all taken from a very much over-crowded stand of young red pine and they can hardly be considered as normal. The series obtained, however, compared very closely with Jonson's Scotch pine series in the lower half of the stem, but showed a marked falling off in the top sections. The average age of the trees was 42 years, average height was 46 feet, and average d.b.h. only 5.2 inches.

White Pine—Form Class 50.7—Average 5 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>White pine</i>	100	93.	85.5	77.8	69.	59.7	49.4	37.6	25.5	12.5
<i>Scotch pine</i> computed	100	93.	85.6	77.6	69.	59.7	49.6	38.4	25.7	11.8
Variation in per cent		±0	—0.1	+0.2	±0	....	—0.2	—0.8	—0.2	+0.7
Absolute formfactor, white pine 0.400, Scotch pine 0.400.										
Average age, 40 years.										
Average height, 41 feet.										
Average d. b. h., 6.3 inches.										

White Pine—Form Class 65.5—Average 15 Trees.

[illegible]

White Pine—Form Class 70.8—Average 9 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>White pine</i>	100	95.2	90.6	84.9	78.6	70.8	60.	48.5	34.9	18.
<i>Scotch pine</i> computed	100	95.4	90.3	84.5	78.1	70.8	62.1	51.7	38.4	20.4
Variation in per cent		-0.2	+0.3	+0.4	+0.5	....	-2.1	-3.2	-3.3	-2.4
Absolute formfactor, white pine 0.482, Scotch pine, 0.489.										
Average age of trees, 40 years.										
Average height, 52.8 feet.										
Average d. b. h., 6.5 inches.										

White Spruce—Form Class 65.2—Average 6 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>White spruce</i>	100	94.3	87.4	80.6	73.3	65.2	55.5	44.7	32.7	18.2
<i>Norway spruce</i> , computed	100	94.2	87.9	81.0	73.6	65.2	55.8	45.3	32.9	18.2
Variation in per cent		+0.1	-0.5	-0.4	-0.3	....	-0.3	-0.6	-0.2	±0
Absolute formfactor, white spruce 0.441, Norway spruce, 0.444.										
Average age, 45 years.										
Average total height, 53 feet.										
Average d. b. h., 8.3 inches.										

If we compare our series for white pine and red pine, obtained from actual measurements, and the mathematically computed series for Scotch pine, we find that all series agree remarkable well in the lower six or seven-tenths. The series for form classes 60 and 65 coincide with the Scotch pine series also at the eight and nine-tenths. Form classes 70, 75, and 80, however, for white pine and red pine show a larger taper in the two top sections than Scotch pine. As mentioned above, Jonson had a similar experience with Scotch pine and spruce which were growing rapidly in height, and we are inclined to concur in the view held by Jonson that this is a temporary deviation from the form class curve, which will gradually become less as the trees grow older. We are strengthened in this our opinion by the series obtained in connection with the investigations in British Columbia, where the trees were older and where the curves obtained did not show this tendency to drop in the tops. Furthermore, trees belonging to

form classes 60 and 65 which grew in more open positions, and which consequently had poorer stemform and grew, as a rule, less rapidly in height, gave average taper series which agreed very closely with the computed series in all parts of the stem. From the above it would appear as if the stems of white pine and red pine inside bark were built very much like Scotch pine, Norway spruce, and larch in Sweden, providing the absolute form quotient or the form class is the same. Consequently, Jonson's taper and volume tables for the above Scandinavian species should be applicable to white and red pine, at least in the locality where the sample trees were taken. That there, at any rate, will be nothing but a very small difference is apparent from the results obtained in using Jonson's volume table to ascertain the total cubic content of the felled sample trees and comparing this with the cubic content obtained by computing the volume of the stem below breast height, and of each tenth above d.b.h., according to Smalian's formula. The result is as follows:

Measured volume, 87 red pine, 537 cubic feet.

Jonson's tables, 87 red pine, 542.6 cubic feet—Difference, 1 per cent.

Measured volume, 41 white pine, 215.6 cubic feet.

Jonson's tables, 41 white pine, 216.9 cubic feet—Difference, 0.6 per cent.

The difference in the volume of 13 white spruce was 1.8 per cent and in 6 jack pine 2.2 per cent.

That a somewhat lower figure was obtained from the actual measurement is, no doubt, chiefly due to the greater taper in the tops of our sample trees. To ascertain, however, if older trees would not give a still closer result, the volume of 19 lodgepole pine, for which very accurate measurements were available, was obtained from the volume table. The content of the trees was 462 cubic feet by measurement and 465 cubic feet by the volume table, a difference of 0.6 per cent.

The stem form investigations in the east have so far been carried on only at the Forest Experiment Station of the Dominion Forest Service at Petawawa, Ontario. That such distinct and regular taper curves, which agree remarkably well with Jonson's series, have been obtained for each form class proves to us that for all normal red and white pine, that is, trees where the root swelling does not reach above breast height or which are not of otherwise faulty growth, the Jonson "absolute form quotient" is an excellent expression of taper or stem form. We believe that Jonson's universal volume tables can be used with great

accuracy in estimating the total volume content of white pine and red pine, and spruce stands in Canada, providing that the diameter breast height is measured just above the root swelling, if such is present, and providing of course that the average form class of the stand is ascertained correctly.

The following series for form classes 60, 65, 70, 75, and 80, made from measurements at Petawawa, as demonstrated above, agree closely with Jonson's series, and the inference is that tables based on these series will prove accurate when applied generally, but, of course, such a statement cannot be made until measurements have been secured from trees of all ages and sizes, spread over the entire range of the tree. To this end, we invite the co-operation of foresters in Canada and the United States to take form quotient measurements of typical trees and send in their figures. The assistance thus received will be of great value and will be much appreciated.

The final series were obtained from the averages of the white and red pine series by graphical interpolation. The average values at the eighth and ninth cross section in form classes 70, 75, and 80 have been somewhat raised for reasons which have been discussed above.

Average Taper Series Inside Bark for White Pine and Red Pine Obtained from Measurements on Felled Sample Trees in Young and Medium Aged Stands.

Form class		Diameter in per cent of d. b. h. at each tenth of stem above b. h.								
d	b. h.	1/10	2/10	3/10	4/10	5/10	6/10	7/10	8/10	9/10
$\frac{d}{D}$										
0.60	100	93.2	85.8	77.9	69.4	60	50	38.4	25.9	12.9
0.65	100	94.3	88.0	81	73.6	65	55.4	43.8	30.6	15.6
0.70	100	95.3	90.2	84.3	77.8	70	60.7	49.5	35.8	19.2
0.75	100	96.2	91.8	87	81.8	75	66.7	56	41.5	23.2
0.80	100	97	93.7	89.7	85.4	80	73	62.7	48.5	28.7

INVESTIGATIONS IN BRITISH COLUMBIA

A considerable amount of investigation has been carried on in British Columbia on Douglas fir, white pine, white spruce, Engelman's spruce, balsam, and hemlock. The measurements were not taken at each tenth above d.b.h. as in the East, but at breast height and at each 16 feet. These measurements (inside bark) were then plotted on cross-section paper and the diameter at each tenth read off and the

quotients determined. Average series were thereafter constructed. It was found, however, that the series did not as a rule agree very well with Jonson's series or with those obtained in the East. *This is, no doubt, due almost altogether to the root swelling which occurs on practically all large trees* and runs up quite high in some species, often to 12 or even 20 feet above the ground. It is obvious that in dividing the diameters at each tenth above breast height with an "abnormal" breast height diameter, we will obtain an abnormal series of quotients.

Eleven Douglas fir were measured. The average of these was a tree 111 feet high, with a d.b.h. inside bark of 15 inches, and with the following diameter measurements: At 19 feet above ground, 12.9 inches; at 35 feet, 11.9 inches; at 51 feet, 10.9 inches; at 67 feet, 9.4 inches; at 83 feet, 7.5 inches, and at 100 feet, 4 inches, all inside bark. These measurements were plotted on cross-section paper and a curve representing the taper of the tree drawn through the known points. This showed that at 18 feet above the ground the curve began to swing outwards on account of the butt swelling. To do away with this swelling, however, the curve was prolonged downwards from the point according to its natural trend and a "normal" breast height diameter of 13.4 inches was obtained. This new breast height diameter was divided into the diameter at each tenth above breast height read off on the curve, and the following taper series obtained:

Douglas Fir—Form Class 77.3—Average 11 Trees.

Diam. at sec. in per cent of d. b. h.	0 (b. h.)	I	II	III	IV	V	VI	VII	VIII	IX
<i>Douglas fir</i>	100	96.6	92.8	88.4	83.4	77.3	69.4	60.5	48.6	29.5
<i>Scotch pine</i>	100	96.5	92.7	88.2	83.3	77.3	70.2	61.2	48.9	29.7
Variation in per cent		+0.1	+0.1	+0.2	+0.1	....	—0.8	—0.7	—0.3	—0.2
Absolute formfactor, Douglas fir 0.554, Scotch pine 0.555.										

Again we find a surprisingly good conformity between the two series.

Western white pine was also given a trial. The average of 16 trees was a tree 130 feet high with a breast height diameter at 19.5 inches inside bark. Here the two series were after correction for root swelling, the "normal" diameter being 18.1 inches:

<i>Western white pine</i>	100	95.0	89.2	82.6	75.7	69.3	60.1	50.8	38.7	22.7
<i>Scotch pine</i>	100	95.1	89.4	83.5	76.7	69.3	59.0	49.4	36.1	18.5
Variation in per cent		—0.1	—0.2	—0.9	—1.0	....	+1.1	+1.4	+2.6	+4.2

A number of *white spruce* (Upper Fraser Valley), *Engelmann spruce*, *western hemlock*, and *balsam fir* were analyzed. It would make this article altogether too long, however, to describe in detail the series obtained. This must be said, however: Whenever root swelling reached above breast height we obtained an absolute form quotient ($\frac{d}{D}$) or form class which was lower than the form class indicated by the form of the bole above the root swelling.

The analysis of the sample trees has shown, however, that if we base the taper series on the "normal" d.b.h. of the tree we obtain series that correspond very closely with the eastern series and with Jonson's mathematically computed series.

It is found that root swelling does not as a rule materially affect the breast height diameters in trees less than 12 inches. For instance, 41 western white spruce, with an average d.b.h. of 10 inches, gave series that agreed almost exactly with Jonson's series for Norway spruce of the same form class. The same is true in regard to balsam fir, Douglas fir, and other species.

Prof. Jonson and Mattson-Marn have found that normal Norway spruce, Scotch pine, and larch, whether large or small, are similarly built, provided they have the same absolute form quotient. From the limited number of measurements taken in Canada it would appear as if the same could also be said about our Canadian conifers.

The falling off in the top sections which was found in the young, fast growing trees examined in the East was not noticed in the series for the western species, where all trees examined were larger and older than in the East. From the series constructed for each form class, which give us the dimensions in per cent of diameter at breast height at any point of the stem, it is of course possible to construct taper tables and any kind of volume table, whether in cubic feet, board feet, or ties. If we know the form class, the d.b.h., and the total height, we know from our taper tables what the diameter is at the top of each 16-foot log, we know at what height on the stem the diameter is 8 inches, 6 inches, or 4 inches, etc.

In using a form class table it is of course necessary to know the diameters, the heights, and the form class of the trees in the stand. Diameters are measured, heights are obtained from a height curve constructed from measurements of a few representative trees in each important stand, and the average form class is obtained either from felled sample trees by Jonson's form point method or by judging the

average form class in the stand. The form class varied considerably within the same stand, especially in uneven-aged and open stands.

We believe, however, that in ordinary cruising it will be possible to judge the average form class outside bark of the stand by eye with sufficient accuracy. Density is a good criterion of the *average* form of the trees in the stand. Poor density gives lower form class and good density higher form class. In the East, form class 80 was only found in a partially overcrowded stand of red pine and then only in individual trees, the average being 75 inside bark and 73.3 outside bark. Another red pine stand with normal density gave form class 69 inside bark and 68 outside bark, and another fine looking red pine stand of full density had form class 71 inside bark and 70 outside bark. Jack pine of full density gave form class 68.7 inside bark and 67.3 outside bark. A plot of white pine, spruce, and balsam gave the following average form classes:—

White pine.....	68.8 inside bark, 68.4 outside bark
Balsam	68.0 inside bark, 68.0 outside bark
White spruce.....	65.8 inside bark, 65.9 outside bark

The following form class figures inside bark have been found to represent the average at Petawawa:

Overcrowded stands.....	75 outside bark
Very good density.....	70 outside bark
Good density	65 outside bark
Open	62.5 outside bark
Very open	60 outside bark

The large trees in even-aged stands have as a rule a somewhat lower form class than the smaller ones.

The Swedish investigators have found that the average form class of the stand coincides closely with the form class of the average tree in the stand. Whether or not this is the case here we are not yet able to say, but the indications seem to point that way.

All taper series and volumes referred to in this article are based on the inside bark measurements. It is, of course, necessary to first study the stem form of trees inside bark so that the laws of taper of the wood stem may be ascertained. The bark generally lowers the form class and the relation between the form class inside and outside bark can only be arrived at after very extensive bark studies. Such investigations must be concentrated for each species upon the thickness of bark at breast height and upon the taper of the bark with increasing height

on stem. The thickness of the bark is, no doubt, dependent upon the absolute dimensions of the tree, upon age, locality and situation, and perhaps also on the density of the stand.

In this variation of the thickness of bark lies one of the difficulties with respect to the preparation of universal form class volume tables.

We believe that local or regional differences in volume tables arise to a large extent from differences in bark thickness. A comparatively thin-barked species, like spruce, for instance, would not offer so many difficulties in the preparation of a general form class table as, for instance, Douglas fir, with its very variable bark-thickness. Butt swelling is, however, large in spruce.

Of the two writers of this article, the one who has carried on the investigations in the East is better satisfied with the results than his western co-worker; that is, with the possibilities of the application of Jonson's theories for practical purposes in Canada. Root swelling and bark of very varying thickness are against us in the virgin forests of the West. A study of root swelling and thickness of bark in various localities and situations would of course largely reduce the difficulties connected with the preparation of general tables, as apparently the form of the stem inside bark agrees almost exactly with that of an eastern relative of the same form class.

We believe, however, that at any rate Jonson's theory is of great value, even in our big timber, in reducing the number of field measurements required to prepare an ordinary volume table. Working on this basis, a volume table for western white pine form measurements of only 16 trees has been prepared.

The first step was to plat the taper inside the bark of all the trees on cross section paper and to draw one taper curve representing the average of 16. Next a curve was drawn showing the percentage of the d.b.h. inside bark of the diameters at different per cents of the length above breast height. Then, from this curve the value in per cent of d.b.h. of the top diameter of each 16-foot log above a 2-foot stump was determined for five 20-foot height classes (80 to 160 feet.)

Average bark thickness at d.b.h. was determined for each diameter class from the field measurements and subtracted from each 2-inch diameter class, thus giving the inside bark diameter class. From this last the diameters at the top of each log were determined, the logs were scaled, and the b.f. contents of each tree computed.

Finally, these figures were evened off by curves and the final volume table read off.

The principle used in making this table is, we believe, correct, but it might be better to have a larger number of trees to work on and make a separate curve for the large d.b.h. sizes, medium sizes, and small sizes.

By the same method a volume table for Sitka spruce on Queen Charlotte Island was worked out. This table seems rather high, however, but this was probably due to the fact that it was based on trees without much root swelling and therefore of better form than the average. One objection to the use of a form class table based on total height on the Pacific Coast is that the trees are often so high that the tops are hard to see. Therefore, a merchantable height classification is more suitable.

Also, the determination of the average form class, whether by Jonson's form point method or by ocular estimate, is more or less difficult. However, what we have tried to prove with our investigations so far is that the absolute form quotient expresses the percentic taper of a coniferous tree and that conifers with the same form quotient or of the same form class are formed according to the same model, at least in the merchantable portion of the tree. Judging from our present material, we believe that such is the case. The difficulty is to estimate the form class of a standing tree or the average form class of a stand, but, as explained above, we believe that a little practice will overcome this.

The form class method is no doubt best adapted for use in second-growth stands, especially if they are even-aged, but it can also be used to great advantage in preparing local volume tables in virgin stands of very large timber.

The form point method of determining form class was briefly mentioned in the article about the absolute form quotient in the May, 1918, number of the JOURNAL OF FORESTRY.

For those who might be interested in this subject we would refer to Bulletin No. 6-8, 1918, of the Swedish Institute of Experimental Forestry, which contains an article, "The Form Point as an Expression of the Trunk Form," by Sven Petrini, of which article a summary is given in English.

THE MANAGEMENT OF SECOND GROWTH WHITE PINE IN CENTRAL NEW ENGLAND

BY R. T. FISHER AND E. I. TERRY

ORIGIN OF EXISTING STANDS

The so-called pine woodlots, which make up about four-fifths of the timber cut in central New England, are usually even-aged, and contain from 50 to 100 per cent white pine. Almost without exception these stands have originated on vacant land, abandoned pasture, or mowings, sites which, prior to the settlement of the region, bore forests either of hardwood alone or mixed hardwood and softwood. Except for occasional sand plains and thin-soiled summits, the areas which now bear mainly white pine are usually natural hardwood sites. The result of this is seen in the tendency of cut-over lands, so often remarked, to revert to hardwood. At the time of cutting, which is commonly at an age varying from 50 to 70 years, over 90 per cent of the second growth pine lands contain an abundant advance growth of hardwoods and, in the case of the stands of deficient density and on the moister soils, sometimes heavy thickets of underbrush or woody ground cover. Pure pine in the woodlot region is a transition type.

SCOPE AND BASIS OF THE STUDY

The following is a summary of conclusions from an extended study of the management of the white-pine type. It applies to a region including roughly central Massachusetts and southern New Hampshire, an area from which the annual cut of pine lumber for the last 10 years has averaged not far from 200 million board feet. The material here presented is in process of preparation for a paper on general forest management for the locality in question, but the present need of definite results bearing on methods of reproduction seems to justify a brief account both of the actual woods practice which has proved successful, and the investigation which has accompanied it.

The study was intended to correlate the results of experimental cuttings on the Harvard Forest with conditions following the ordinary logging operations in the surrounding region. The Harvard cuttings

have now extended over a period of 10 years, from 1908 to 1919, and have involved the marketing of approximately $2\frac{1}{2}$ million feet of lumber. For purposes of test these cuttings have been made according to the following silvicultural systems: the shelterwood method, the selection method, the seed-tree method, clear-cutting by small groups, by strips, and by lots or areas of several acres. By systematic study on the ground, taken in connection with the annual records of the forest, a thorough recapitulation of comparative silvicultural results was brought together. In respect to other cut-over lands a direct examination was made of the reproduction following 54 separate logging operations. These represented upwards of 4,000 acres scattered through northern Worcester and Hampshire Counties, Massachusetts, and Cheshire County, New Hampshire. The dates of these cuttings fall between 1905 and 1908 inclusive. Each date was definitely ascertained so that results could be correlated with records of seed years, rainfall, etc.

OBSERVATIONS ON CUT-OVER LANDS

Of the 54 separate areas examined only 14 showed satisfactory reproduction of pine. This was taken to mean 500 thrifty seedlings or more per acre. All of these 14 lots were cut in seed years, that is, in the autumn or winter following the fall of seed. Two lots cut in seed years showed no reproduction, the failure being due to the fact that the previous stands were unusually dense and below the seed-bearing age. Of the remaining 40 woodlots cut over in non-seed years, only 10 showed any pine reproduction at all, and of these 10 only one anything like a sufficient seeding. These partially satisfactory results were always explainable on account of accidentally favorable conditions, such as the proximity of seed trees and the smallness of the area cut. The examination showed that general site factors such as slope and aspect had little or no effect, but that the condition of the seed-bed was apparently of first importance. Heavy ground cover and leaf-litter was unfavorable; thin leaf-litter and humus with mineral soil mixed with it or exposed made the best seed-bed. If seedlings failed to start within from 2 to 5 years after the cutting, the development of other vegetation kept them out entirely. Incidentally the study showed that under dense stands no reproduction survives, but that under open or mixed stands advance growth of white pine may survive for years. There was no evidence of reproduction from seed stored in the leaf-

litter more than one year. Outstanding facts were that on all but the lightest of the local soils, the hardwoods are gaining, and that the composition of the present forest types has been controlled in the main by the previous treatment of the land.

Taking the total area of the woodlots examined, about 15 to 20 per cent showed good pine reproduction; on another 20 per cent pine seedlings were scattering. On the other hand from 60 to 70 per cent of lots cut both in seed years and non-seed years, was satisfactorily stocked with valuable hardwoods such as red oak, white ash, hard maple, etc. These figures apply only to the first 10 years after cutting. However successful the reproduction may be at the start, within 10 years from 10 to 80 per cent of the desirable elements, both pine and hardwood, was overtopped and suppressed by inferior species and clumps of stump sprouts.

RESULTS OF CUTTINGS ON THE HARVARD FOREST

In respect to the various ways of handling the pure pine type which have been tested on the Harvard Forest it can be said that all of those methods which involve the removing of the stand in two or more cuts have proved successful. On account of certain practical and financial factors good reproduction, however, is not the only criterion of a workable method. This will perhaps appear more clearly from a statement of experience with the different systems of cutting.

Clear-Cutting the Whole Stand.—This method has been tried on areas of from two to four acres. Cuts were made in the winters following the seed years of 1908 and 1914. All slash was burned in piles. A reproduction followed in which there were from three to four thousand thrifty pine seedlings per acre at the end of four years. This method is obviously the best from the point of view of cheapness in logging, but can be practiced with success only in seed years.

Clear-Cutting in Strips.—Strip cuttings have been made in several different years. The cleared areas varied from 100 to 200 feet in width and in all cases were made on the margin of the stand away from the prevailing wind. The results have been variable. On well-drained sites, where the underbrush and small vegetation was scanty, good reproduction has appeared within five years. On moist or rich land pine has been entirely kept out by dense herbaceous growth.

Clear-Cutting in Patches.—The patches cleared by this method varied from 50 to 100 feet in diameter. The results have been similar

to those on the cleared strips, although the reproduction has been, on the whole, more successful. Abundant seedlings have come in on the drier sites where the competition with woody vegetation was not too keen. This method, like the preceding, is open to the serious objection of greater cost due to the smaller, scattered areas. Furthermore, even if the groups of young growth become established, it is difficult later to log the surrounding uncut timber without undue damage or expense.

The Selection Method.—Small areas cut over by the selection method where only single large trees or groups of trees were cut, have resulted in fair reproduction. It is not, however, a practicable means of handling pure pine, being too costly and not calculated to provide the necessary density and growing conditions for the new crop.

The Seed Tree Method.—All experiments with the seed tree method have proved failures. In many cases the trees blew down. Even when windfirm trees could be selected, woody and herbaceous growth covered the ground before sufficient pine seedlings got started.

The Shelterwood Method.—Of all methods tested this has resulted in the best reproduction. The first cutting has consisted in a uniform thinning in which mainly the overtopped and defective trees were taken. This meant the removal of about one-quarter of the trees and one-fifth of the volume per acre. Up to the point where windfall becomes a risk the heavier the thinning the better was the reproduction. Stands so treated have in five years shown as many as 25,000 seedlings per acre. Where the overwood was allowed to stand more than five years the reproduction became stunted and too weak to recover promptly when the removal cutting was made.

MANAGEMENT NOW IN PRACTICE

The cutting method now in practice on the Harvard Forest, though based largely on the outcome of the experiments above described, was adopted with considerable reference also to practical and financial considerations. The rotation for white pine is set at 60 years. As the working plan is based upon the principle of a sustained annual yield, final cuttings have to be made each year. In this respect the property is in the same case as that of a wood-working concern which requires a steady annual supply. Since seed years for white pine occur not oftener than once in three years, this means that any cutting method

based on the periodic fall of seed must make provision for securing reproduction after the operations of the off years. The established logging and milling methods almost necessitate the clear-cutting of a considerable area in one place, a minimum of not less than 5 to 10 acres. Bearing on the composition of a desirable forest crop is the fact that the present pine woodlots are transition types and as such are difficult to maintain. Furthermore, the market for the better hardwoods has greatly improved, and bids fair to improve still more in the near future. In view of these considerations, it has become the silvicultural policy on the Harvard Forest to replace the pure pine type with mixed stands containing, in addition to pine, the best of the local hardwoods, an abundance of which is almost always present on the ground.

The method of cutting is a combination of preliminary thinning with clear-cutting. Each year an area large enough to yield the bulk of the annual cut is cleared, and ordinarily thinnings are made on adjacent areas in amounts sufficient to yield the balance of the total cut. The object of the thinnings is primarily to stimulate reproduction of pine so that it will be available when and where cuttings are made in non-seed years. In years when there is a heavy fall of seed a clear-cutting made without preliminary thinning, especially if the operation is carried out on bare ground, results in successful reproduction. Thus there is no rigid relation between the clear-cuttings and the thinnings, either in area or time. In some years, for convenience in logging, the thinnings may be omitted; in other years, where the location is favorable, an extra large area may be thinned. Each year, however, the bulk of the operation is a clear-cutting which keeps the cost of the job within reasonable limits.

Before the final clear-cutting is begun all the advance growth, hardwood and underbrush, both small and large, is cut close to the ground. Usually this can be done with a bush-scythe and at a rate of an acre or an acre-and-a-half per man per day. The purpose of this is to eliminate misshapen and overdeveloped reproduction and to insure the uniform starting of straight, vigorous, seedling sprouts. Cost records show that the work is much more than paid for by a saving in the cutting and hauling of logs due to the much greater ease of handling and loading. When the logging starts the slash is burned in piles, much of it in broken time while the job is in progress. The cost of slash burning has varied from fifteen to fifty cents per thousand.

depending mainly on the crown form and density of the stand. But here again the burning can often be handled so as to cheapen other parts of the job. In any case, it does not bear any very serious relation to the net return on the timber, and, for a permanent land owner, is properly chargeable to fire protection. When the operation is over the land is thus entirely clear, with a prospective crop consisting of from 5,000 to 20,000 pine seedlings per acre in addition to the hardwood advance growth about to start. The following table gives a summary by species of the reproduction secured on a typical acre which has been cut over in this manner.

Summary of reproduction, October, 1917. Thinnings made 1911-1912—Removal cutting 1915-1916.

[Number per acre.]

Species	2 years old	3 years old	Over 3 years	Total
White pine	410	2,870	70	3,350
	Seedlings	Seedling sp'ts	Stump sp'ts	Total
White ash	390	1,990	20	2,400
Red oak	20	540	10	570
Chestnut	10	510	40	560
Black cherry	360	890	...	1,250
Red maple	9,000	1,000	40	10,040
Hard maple .....	.....	10	10	20
Basswood	10	40	10	60
Beech .....	.....	.....	10	10
Black and paper birch.....	.....	200	...	200
Gray birch	130	.....	...	130
Total.....	9,920	5,180	140	15,240

DAMAGE FROM SNOOT BEETLES AND WEEVILS

It is a further recommendation of this combination of thinning with clear-cutting that it tends to offset the inevitable losses due to the snout beetle (*Hylobius pales*) and the pine weevil (*Pissodes strobi*). The work of the snout beetle was first described by E. E. Carter in a paper entitled, "Hylobius Pales as a Factor in the Reproduction of Conifers in New England" (Proceedings of the Society of American Foresters, Vol. XI, No. 3, July, 1916). These beetles, breeding probably in the fresh cut stumps, swarm upon cut-over pine land and remain active for two growing seasons, during which period they destroy up to 80 per cent of all the pine seedlings over two years old. If a second contiguous cutting is made within three years the infesta-

tion is prolonged or renewed upon the area previously attacked. After this interval the reproduction is usually too large to be seriously injured. In two cases where the lumber was piled directly on the ground from which it was cut, thereby attracting the beetles in larger numbers, the destruction was practically complete over several acres. (Observation of H. B. Pierson.) As a rule, however, the amount of pine reproduction secured by thinning is so large that, even after the beetles have taken a toll amounting to 75 per cent, enough remains to form, with the hardwoods, a valuable stand. Furthermore, since the beetles do not eat one year seedlings, cuttings made without previous thinning in seed years are followed by comparatively little loss.

Injuries by the pine weevil begin usually in the small sapling stage. Their chief drawback is that they check the height growth of the pine at the very period when it is essential for keeping pace with the hardwood. The weevil, however, is less numerous in the mixed growth of cut-over lands than in pure pine plantations. Both weevil and snout beetle seem, so far, beyond the reach of any effective check, so that to provide more food than they can eat seems to be the safest provision against them.

WEEDING ESSENTIAL FOR THE NEW CROP

As a result of experience in the Harvard Forest nothing is clearer than that the critical period for a forest is in the small sapling stage. The money value of the final crop can be more greatly influenced by proper treatment at this time than at any other stage of the rotation. The young growth summarized in the table above, from the standpoint of quantity and species, is potentially more than sufficient to produce a full stand of good timber. Actually, if left to itself, it will never reach a valuable maturity. The new crop, therefore, has to be weeded, once when it is from 3 to 5 years old, and again when it is from 8 to 10 years old. It is only after about 3 years that the harmful effects of crowding begin to be apparent and the inevitable damage to pine seedlings from snout beetles, and to hardwoods from deer and rodents can be accurately discounted. After about 10 years the pine and hardwoods of seedling origin have reached a uniform and roughly equal rate of height growth. Meanwhile, however, the weed elements in the stand will have again become dominant, so that the cleaning has to be repeated. On light, sandy soils a satisfactory result can be achieved with one weeding, applied in such cases after a longer

interval. On rich, moist sites it is occasionally necessary to weed the crop a third time, in order that the best advantage may be taken of the very productive land. When this work is begun at the proper time, that is, before the crop has passed the small sapling stage, it can be done at the rate of $1\frac{1}{2}$ to $2\frac{1}{2}$ acres per man per day. On the Harvard Forest areas which have been weeded twice and which are in condition to produce valuable timber without further expense have cost, for reproduction, from \$7 to \$9 per acre.

EXPECTABLE YIELDS

Exact figures bearing on the final yield of such weeded stands of mixed hardwoods and pine are lacking. They can be approximated, however, by reference to existing stands where, over small areas, similar mixtures of species have reached maturity. The yield for well-stocked natural-pine stands, as based on the mill figures, runs from 40,000 to 55,000 feet per acre at 6 years. For mixed stands of the same age the yield varies from 20,000 to 35,000 feet per acre being higher according as the percentage of pine in the mixture is higher. These figures all apply to natural stands in which irregularity of stocking and abnormalities of crown development create a very considerable waste of growing space. It seems fair to assume, therefore, that in a stand where both distribution and mixture have been properly regulated by early weedings, the yield will not only be better in quality, but at least equal in quantity the production of volunteer growth. On suitable sites red oak and white ash, for example, will produce two to three log timber of the highest quality at 60 years. Speculation as to lumber prices 60 years hence is perhaps uncertain, but it is certain that they will be no lower than they are today. If, therefore, the mixed stands produced by the management above described are reckoned as yielding a final volume of 35,000 feet per acre, the value of the crop at present stumpage prices will be from \$400 to \$500. Given a reasonable security from fire and fairly equitable taxation this seems a satisfactory return on an investment of not less than \$10 per acre.

SIMPLEST POLICY FOR THE REGION

It is difficult to reduce practical silviculture to a rule-of-thumb. Only the knowledge that comes from residence experience in a given

silvical region can apply the best treatment for varying forest conditions. Nevertheless for much of central New England, where the second growth forests are vigorous and prolific and, for the most part, uninjured by fire, a very simple policy will go far toward maintaining forest production. Slash disposal, while not indispensable on hardwood lands, must be carried out on pine lands. The wind-rows of tops on cut-over pine woodlots often cover from 30 to 50 per cent of the ground surface and so densely as to preclude all reproduction. There is thus a serious waste of growing space in addition to the fire risk. The better the market and the greater the available technical skill the more intensive can be the methods applied to forest production. But, if on either pine or hardwood land, merely the present clear-cutting is practiced, on a rotation of not less than fifty years, if slash is disposed of and fire subsequently kept out, it will be a long step toward successful forestry.

EFFICIENT REGULATION OF GRAZING IN RELATION TO TIMBER PRODUCTION ¹

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I am by no means sure that this paper presents anything new on the subject announced. From correspondence, reports, and contact with field officers during the past few years, however, it has struck me that further consideration of the major data available might be worth while with a view of deciding more fully their meaning and their application in the management of the National Forests. No attempt is made to review investigations and experience outside of the United States, partly because I am not qualified for such a task and because I have found difficulty in considering data available in the Forest Service alone within the limits of this paper. It is not intended that the data or conclusions apply to eastern forests.

RESULTS OF INVESTIGATIONS

In 1897, at the request of the Department of the Interior, Mr. Frederick V. Coville, representing the Department of Agriculture, made an investigation of forest growth and sheep grazing in the Cascade Mountains of Oregon. The reason for the investigation is clear from the opening sentence of Mr. Coville's published report ² as follows:

"For the past few years a bitter controversy has been waged in Oregon on the question of grazing sheep in the Cascade Range Forest Reserve."

This reserve contained 4,492,800 acres embracing the main ridge of the Cascades and a broad strip on either slope.

The following quoted from Mr. Coville's published report represents his conclusion regarding forest growth and sheep grazing:

"Over most of the reserve the actual damage to the young growth of timber is up to the present time confined chiefly to small areas, such as bedding grounds and routes of travel. In such situations the young pines, low enough

¹ Address before the Washington, D. C., Section, Society of American Foresters, December 11, 1919.

² Coville, Frederick V., Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon. U. S. Dept. of Agr., Div. of Forestry, Bull. No. 15, 1898.

to be reached and nibbled by the sheep, may be seen standing crooked and incapable of developing into sound trees of a healthy growth, while seedlings are trampled out entirely. The trouble from this source, however, is constantly misunderstood on both sides. I passed through an area of forest land on McKay Mountain, a western spur of the Blue Mountains lying in a direction northeast from Pineville, where sheep had been grazed for twenty-five years. This is the oldest sheep range in Cook County. In these forests were frequent areas of young saplings of thoroughly healthy and symmetrical form which unquestionably had not received the slightest injury from sheep grazing. At the same time along the road were seen frequently the gnarled and stunted pine saplings, which showed clearly what doubtless occurred over wider areas where overgrazing and trampling were similarly carried to an extreme."

As a result of his investigations Mr. Coville recommended that moderate grazing of sheep in the Cascades be allowed under regulation, moderate grazing being defined as "grazing only to such an extent that the forage crop does not decrease from year to year."

Aside from comments in the supervisors' annual grazing reports we have little additional on this subject from Oregon until Munger's monograph on western yellow pine in Oregon³ appeared in 1917. Munger disposes of the subject with the following brief statement:

"Since yellow-pine forests are grazed over by sheep and cattle, the reproduction is somewhat exposed to damage by these animals, particularly by sheep, which trample a good many seedlings when close herded. Sheep also, when short of forage, as along driveways or near bed grounds, browse on them in such a way as to deform the seedlings permanently. If the range is not overstocked and the sheep are properly handled, they will not, in Oregon, do any appreciable damage to the yellow-pine young growth in the forest at large; trees over 6 feet high are practically immune from damage."

In their annual grazing reports for 1917 eighteen of the supervisors of District 6 reported no damage to tree reproduction from grazing; three reported no appreciable damage, slight injury, or injury not serious.

Sparhawk's investigations into the effect of grazing upon western yellow pine reproduction in Central Idaho give more in detail what probably is true of certain parts of Oregon and Washington. These investigations were conducted on the Payette Forest in Idaho, over a period of three years, 1912-14. They were thorough and his published report⁴ contains so much of value that I find difficulty in giving the essentials without giving the entire text. However, I have attempted to outline the data and conclusions of greatest importance as follows:

³ Munger, Thornton T., *Western Yellow Pine in Oregon*. U. S. Dept. Agr. Bull. 418, 1917.

⁴ Sparhawk, W. N., *Effect of Grazing Upon Western Yellow Pine Reproduction in Central Idaho*. U. S. Dept. Agr. Bull. 738, 1918.

1. *Amount of injury*: "The damage to seedlings more than a year old was negligible in quantity"; a yearly average of about 2.8 per cent.

Of seedlings less than one year old an average of 15.4 per cent on the Deadwood area and 24.9 per cent on Silver Creek were killed.

These figures, according to Sparhawk, represent the damage on grazed plots only, and indicate "the maximum loss which would result if the sheep grazed over every square yard of their allotment." He points out "that an area is seldom grazed so closely unless it is much overstocked; a great many spots are missed, and many of them are likely to be patches of reproduction, since there is usually little palatable forage in such places."

Of the total seedlings over one year of age on all plots, both grazed and ungrazed, 1.1 per cent were killed each year on the Deadwood range, which was lightly grazed, and 2.5 per cent on closely grazed Silver Creek range.

Of seedlings less than 1 year of age, on all plots, 8.8 per cent on Deadwood and 14.8 per cent on Silver Creek were killed each year.

Computations based upon the annual data collected show that about 45 per cent of the western yellow pine which germinates will eventually be killed if the area is grazed completely every year; or about 7.2 per cent will be killed if grazing is eliminated until the seedlings pass the third year of age.

"During the first few years seedlings succumb very easily to slight injuries, because of their small size, shallow root system, and the lack of woody matter in their stems. The loss due to grazing decreased from about 20 per cent for seedlings in their first year to 11 per cent for those in their second and third years. By the end of the third year they are from 2 to 4 inches high (depending on species and site), their stems have become woody and fairly tough, and their roots penetrate the soil for a foot or more, so that they are not easily uprooted by trampling nor exposed to drying by the loosening of the soil. Injury from grazing is so slight after this that there is no need for closing reproduction areas to sheep after the third year, though it may be desirable to graze such areas lightly for a few years more, until the seedlings reach a height of 6 inches."

2. *Season of injury*: "The proportion of seedlings killed by grazing, particularly of those less than a year old, was very much greater early in the season than it was later. The reasons for this are that early in summer the seedlings are rather brittle, with little wood in their stems; their roots do not go down very deep; the soil is moist and easily shoved out of place by the sheep; and seedlings injured early are either killed outright or have small chance to recover because of the dry period which follows the injury. By the middle of August the season's growth is nearly completed, the stems are tougher, the roots deeper and more widely spread, the soil is more firmly packed, and an injury is soon followed by the fall rainy period and the long winter period of rest, so that there is a fair chance for recovery from slight disturbance."

3. *Relation between amount or damage and intensity of grazing*: "As would be expected, the amount of injury and death increased fairly constantly with increased intensity of grazing. Except on bed grounds and areas grazed with similar intensity, the damage was not very serious for seedlings more than a year old, and even in such places only 4 per cent of the seedlings were killed.

A considerable proportion, from 20 to 30 per cent, of those less than a year old were killed on all except the lightly grazed plots, where only 6.5 per cent were lost."

"After their third year a very small proportion of seedlings, less than 1 per cent per year, is killed by grazing of moderate intensity; that is, by grazing close enough to utilize practically all of the palatable forage."

"Very few seedlings were browsed on the experimental areas on bed grounds used for one night only. However, if sheep are driven back to the same bed the next night, or at any time before a full new crop of foliage has sprung up, the damage by browsing is almost always very serious, as there remain only the least palatable forage plants and the conifers. On bed grounds used for several times in succession every green leaf is removed, and even the bark of saplings up to several inches in diameter is gnawed off. For like reason similar conditions prevail along driveways used for several bands of sheep."

4. *Amount of damage and amount and character of forage:* "The quantity of palatable forage on a given area may affect the amount of damage done in two ways. If the total quantity of feed is too small for the number of stock allotted to the area, there will probably be considerable browsing injury and more injury from trampling than if there is abundant feed so that the sheep need not wander around looking for it. On the other hand, whether the allotment as a whole has ample forage for the allotted stock or not, the injury due to trampling, which causes most of the deaths of small seedlings, is likely to be greatest on those parts of the allotment where the amount of palatable forage is greatest. The reason for this is that the sheep will spend more time where forage is abundant than where it is scanty."

5. *Valuation of damage:* "Table 17, which shows the number of seedlings per acre actually present on the plots on all three allotments in the spring of 1914, indicates plainly that there was sufficient reproduction present to make a full stand in spite of grazing injuries. On areas as well stocked with reproduction as those covered by the study the comparatively small amount of scattered injury which results when the stock is carefully managed can hardly be said to represent a tangible loss of value."

"Where the number of seedlings present is already insufficient to make a full stand at maturity, or where injuries are concentrated, as on trails, bed grounds, or very seriously overgrazed areas, so as practically to eliminate all reproduction over a continuous area of any considerable size, there is a loss."

6. *Benefits of sheep grazing to the forest:* Aid to reproduction; "The value of sheep grazing in helping tree reproduction to start is frequently overestimated." It does result in more abundant germination under certain conditions, viz., in case of heavy grazing on poor sites where the soil was so dry and lacking in organic matter as to be very unfavorable to reproduction, but the sheep, bedding in the same place for several successive nights, left a thick layer of mulch, so that seedlings not only germinated in greater numbers, but grew much more vigorously than those on the lightly grazed plot. Light or moderate grazing did not have this result, and on sites naturally favorable to reproduction even close grazing may not result in greater germination.

Grazing does not aid to any appreciable extent in securing germination by "harrowing" seed into the soil.

In their annual grazing reports for 1917, nine of the supervisors of District 4 reported no damage to timber reproduction; fifteen reported no appreciable damage, slight damage, or injury not serious.

In California there have been a number of investigations started on the subject, but few have been carried to definite, reliable conclusions. The question was much under discussion and a bone of contention about 1910. In 1911 Sampson and Dayton began a rather comprehensive investigation into the relation of grazing to timber reproduction on the Shasta National Forest. Based upon three examinations in 1911 and 1912 of plots containing 11,040 plants of age subject to inquiry by grazing, the following figures were published⁵: Sheep grazed 38.24 per cent and cattle 8.09 per cent of the yellow pine, sheep 21.75 per cent and cattle 18.93 per cent of Douglas fir, sheep 48.33 per cent and cattle 10.97 per cent of white fir, sheep 26.92 per cent and cattle 12.5 per cent of sugar pine. These figures include all injury however slight. In most cases the plants fully recovered. In the years 1911 and 1912 only 0.03 per cent of the 10,888 specimens on the plots were killed by grazing.

The large number grazed and the small fatalities were probably due to the large number of plants on the plots, an average of 263 per plot of 12 feet by 50 feet.

The investigations were continued in 1913. The complete results tabulated, but not published, confirm in a general way the data quoted.

In their annual grazing reports for 1917 eleven of the supervisors of California reported no damage to timber reproduction from grazing; three reported injury, but not serious; two reported slight injury, more than offset by reduction of fire danger and others reported probable injury, but not enough to affect the stand of reproduction. Among the grazing reports already received for 1919 several of the supervisors of District 5 have reported that tree growth is reducing the grazing resources on their Forests. Reductions in numbers of stock on this account are already being planned for.

In Arizona and New Mexico the situation is somewhat different from California and Oregon and has been a matter of discussion since the creation of the National Forests.

⁵ Sampson, Arthur W., and Dayton, W. A., *Relation of Grazing to Timber Reproduction*, Shasta National Forest. Review of Forest Service Investigations, Vol. II, 1912.

In 1908 Pearson made observations to determine grazing damage to western yellow pine reproduction on the Coconino. He reported⁶ damage to seedlings 1, 2, and 3 years of age under open range grazing varying from 10 per cent to 28.2 per cent. On one plot typical of driveways and bedding grounds he found a damage of 68.3 per cent. His investigations showed that horses and cattle do little damage.

Pearson's data are difficult to evaluate because he does not give information as to the character of range, the time of grazing, the intensity of grazing or the way in which the sheep were handled on the area studied.

His summary, however, that "sheep severely injure seedlings by browsing, and to a less extent by trampling," undoubtedly was warranted. His further conclusion that "sheep should, therefore, be excluded from areas on which reproduction is desired" may have been the right conclusion for the areas studied. It may, perhaps, be the right conclusion for many other areas. It seems doubtful, however, if the study upon which the conclusions were based was comprehensive enough to warrant insistence upon carrying out such a policy without qualification as to areas.

Accordingly the observations started by Pearson were resumed and expanded under his direction in 1910 and were followed up by Hill in 1912, 1913,⁷ and 1914.

Hill's report, like Sparhawk's, requires careful study as a whole for a thorough understanding of the results. For the purpose of this paper, however, the essential data and conclusions are as follows:

1. Average Amount of Injury: Over a period of three years on 250 plots an average of 16.7 per cent of the seedlings up to 5½ feet in height were severely damaged each year and an additional 16.1 per cent were moderately damaged. By severely damaged was meant that injury, if continued, would seriously interfere with the development of the plants, resulting either in death or prevention of ultimate development. Moderately damaged was applied to injury which would not prevent the ultimate development of the tree, even if repeated in succeeding years until the tree developed beyond injury by grazing.

An average of 21 per cent of the seedlings below 6 inches in height were seriously damaged annually. The damage gradually decreased with increase in height.

⁶ Pearson, G. A., *Reproduction of Western Yellow Pine in the Southwest*. U. S. Dept. Agr., Forest Service Cir. 174.

⁷ Hill, Robert R., *Effects of Grazing Upon Western Yellow-pine Reproduction in the National Forests of Arizona and New Mexico*, U. S. Dept. Agr., Bull., 580, Dec. 1917.

2. *Season of Injury*: "The greatest amount of damage occurs during the latter half of June and the first part of July when the effects of the spring dry period are most pronounced. The least damage occurs during the first few weeks of the growing period, or before June 15. A very considerable amount of damage is done during the main growing season and during the fall drying period."

3. *Amount of Damage and Intensity of Grazing*: Under normal conditions of grazing, sheep may be responsible for severe injury to 11 per cent of the reproduction under 5½ feet. Cattle and horses under normal grazing do an inconsiderable amount of damage. *Hill defines normal grazing as grazing where the number of stock is well adapted to the character and amount of forage.*

On overgrazed areas, however, all classes of stock are apt to damage small trees severely. Cattle and horses may injure about 10 per cent of all reproduction. Where sheep are grazed along with cattle and horses at least 35 per cent of the total reproduction may be severely damaged. Ordinarily sheep cause about 7½ times as much damage as cattle.

"The manner in which stock is handled has much to do with the severity of grazing damage. Cattle are likely to injure 22 per cent of the trees between 3 feet and 6 feet in height that grow on areas where they are accustomed to congregate. Sheep severely injure reproduction along driveways and on bed grounds."

4. *Amount of Damage and Character of Forage*: The suitability or lack of suitability of forage on the range to the class of stock has an important influence on the amount of damage to timber reproduction. The general conclusion that but 11 per cent of the reproduction may be injured by normal sheep grazing is believed to apply to grama grass range. On bunchgrass range, however, the damage may be more serious, even though the range is not grazed closely. A special study of sheep grazing on bunchgrass ranges showed a total of 32 per cent of the reproduction subject to injury was severely browsed during 1912 and 1913. A continuation of the conditions then existing would result in severe injury to at least 32 per cent. On a number of plots practically every tree had been killed by grazing. The bunchgrass range under observation was in the north half of the Forest where the bunchgrasses occur in purer stand than is ordinarily the case. Hill concluded, however, that where bunchgrass forms the main part of their feed sheep grazing may result in severe damage to yellow pine reproduction.

Consistent with the conclusions regarding variation in damage to reproduction, due to lack of suitable feed, Hill found that damage during favorable years for forage production was much less than during years of average or less than average production.

Hill's data are lacking as to injury to seedlings immediately following germination. This omission in the investigations was due to the fact that in unfavorable years of the Southwest practically all seedlings which germinate die without injury from grazing, and at best a large percentage die. To determine the part grazing plays during this early age would be difficult as a part of the study undertaken.

H. H. Chapman, in cooperation with other members of the district office at Albuquerque and local forest officers, collected data regarding the effect of grazing on yellow pine reproduction on the Sitgreaves National Forest in 1919. In a memorandum of May 21, Chapman concludes, "That the presence of all the reproduction in those portions of the Chevalon district which are reproduced is due to the fact that sheep have not been present to any extent on these reproduced areas during the years when the seedlings originated and were growing to a height of three feet—and that reproduction is practically absent on all areas continually grazed by sheep for 30 years, while on areas grazed for a lesser period the age classes are absent which would correspond to the period within which sheep have grazed."

In his memorandum of July 9, 1919, reporting conditions on the Heber district of the Sitgreaves, is the following statement:

"The middle area of the Sitgreaves National Forest bore a heavy seed crop of yellow pine in fall of 1913. This crop germinated freely, producing an even, heavy stand of seedlings up to probably 100,000 per acre. The survival of these seedlings was evidently not interfered with by climatic conditions, or drought which sometimes kills most of such a crop. This is evidenced by survival of dense stands on various sites, exposed or otherwise and with little reference to apparent differences in soil conditions, i. e., whenever the type was a yellow pine type originally, yellow pine seedlings are found as survivors of this seed crop, provided they have been protected since then from grazing.

"The survival of this seed crop is therefore a direct measure of the effects of grazing upon the seedlings. The results are the most conspicuous instance yet encountered in this district of the relative influence of sheep and cattle grazing upon yellow pine seedlings."

In his memorandum of July 9, covering the Apache Lumber Company's sale area, is the statement that "The present degree of intensity and method of management of sheep grazing has permitted a very abundant crop of yellow pine seedlings to spring up over nearly the entire area. These seedlings are mostly under one foot in height as yet.

That this reproduction has originated in spite of sheep grazing, and chiefly because it was *not* intensive in character, did *not* make full use of the forage and was not continuous, is conclusively proven by conditions on the adjoining White Mountain Apache Indian Reservation."

Coincident with or following Chapman's investigations Kimball and Westveld were assigned to an administrative investigation to determine the damage to reproduction from grazing and to decide upon the areas in need of protection within the Tusayan and Coconino Na-

tional Forests. Their report is not available. We have, however, a review of their report on sheep damage investigation on the Tusayan National Forest by G. A. Pearson in which Mr. Pearson comments as follows:

"The investigation agrees with previous ones in showing everywhere a great amount of damage by sheep. The number of seedlings over six inches in height from 2 to 6 times as great within enclosed areas as on the sheep range."

Regarding establishment of reproduction on the Tusayan, Pearson states as follows:

"An important point established by Kimball and Westveld is that on the greater portion of the Tusayan yellow pine has restocked satisfactorily despite heavy damage by sheep. This is explained on the theory that about 25 years ago (my personal studies show a still greater seedling crop originating 36 years ago) there was a coincidence of favorable seed and moisture conditions which resulted in establishing so many seedlings that, despite continued sheep grazing, enough survived to give fairly good reproduction. This reasoning appears to me as being sound. At any rate I can see no other way to account for the abundant reproduction which occurs over large areas on the Coconino and Tusayan and which evidently came in while sheep were grazing on these areas.

"The failure to restock on the bunch grass areas north and south of Belmont during the period when good reproduction became established elsewhere is accounted for by the supposition that the extraordinary coincidence of a heavy seed crop and favorable moisture conditions which generally prevailed 25 years ago did not occur on the areas in question.

"Although the explanation of Kimball and Westveld may be accepted there is one important point which they seem to have overlooked, namely, that these areas which have failed to restock would undoubtedly now bear good stand of seedlings and saplings if sheep had been excluded during the last 20 years. This assertion is supported by their comparison of fenced and unfenced areas. I personally have data in this region which prove beyond a doubt that these areas will restock in about 20 years without the occurrence of extraordinary seed crops and moisture conditions, providing that they are given protection against sheep."

Pearson in further discussion points out the advisability of taking steps to insure protection of the 1919 seedling crop from sheep grazing where reproduction is important. He points out that although there is an average of perhaps 20,000 seedlings per acre at least 50 per cent will disappear within a year, due to average climatic conditions and the chances are that the losses will be much greater. On the other hand, if the next two years should bring adverse climatic conditions the loss would be so great that there would be no seedlings to spare for sheep forage. He, therefore, concludes that not to give adequate

protection against sheep grazing would be taking a gambler's chance not compatible with good silviculture.

In their annual grazing reports for 1917, three supervisors in District 3 reported no damage, eight reported injury, but not serious. On the Coconino injury by cattle on 2,000 acres of range was reported as 8 per cent of the reproduction and on sheep range 35,000 acres was reported as having 25 per cent of the reproduction injured. For the Sitgreaves Forest the supervisor reported no serious damage except on stock driveways and that reproduction of varying ages is excellent over virtually all of the yellow pine belt.

The data given apply primarily to western yellow pine. Sampson and Dayton found on the Shasta National Forest that sheep injury from browsing was greatest to white fir, western yellow pine coming second and sugar pine third and Douglas fir least, except incense cedar. Cattle appeared to prefer Douglas fir, with sugar pine second.

Sparhawk concluded that "a much larger proportion of western yellow pine seedlings less than a year old are killed (by sheep grazing) than of Douglas fir, while only half as many of lodgepole pine are killed," but after the third year of growth western yellow pine, as a general thing, is less liable to be killed than Douglas fir or lodgepole pine. White fir, according to Sparhawk's findings is "practically never browsed."

Mason, in his bulletin on utilization and management of lodgepole pine, makes the following statement regarding the protection of lodgepole from grazing:

"On recently cut over areas, sheep grazing should be carefully regulated, if allowed at all, until reproduction is well established. Where an unusually heavy sod is an obstacle to reproduction, heavy grazing by sheep may be a means of exposing the mineral soil."

A study to determine the effects of grazing upon reproduction of aspen was conducted by Sampson over a period of years on the Manti National Forest.⁸ It was found that the leafage of young twigs of aspen is browsed in varying degree by both sheep and cattle. Sheep may be responsible for severe damage to aspen reproduction both in standing timber and on clear cuttings, regardless of the variety and supply of other choice forage. The damage from cattle grazing is usually slight, except where the range is overgrazed and around water, salt licks, and shading and bedding grounds where the cattle congregate.

⁸ Sampson, Arthur W., Effect of Grazing upon Aspen Reproduction. U. S. Dept. Agr. Bull. 741, 1919.

Observations over a period of five years on range instanding timber showed that 27.2 per cent of the aspen reproduction under about 40 inches in height was killed by light sheep grazing; 31.8 per cent by moderate grazing; and 65 per cent by heavy grazing. On clear-cut plots the damage annually was found to be exceedingly heavy. Three years of successive sheep grazing on such plots following clear cutting of the standing timber resulted in complete destruction of the aspen reproduction. After the sprouts reach a height of about 45 inches, which takes about three years, they are beyond destructive browsing by sheep.

The foregoing conclusions apply, no doubt, to other central Utah Forests and to the Humboldt Forest in Nevada. Aspen affords the greater part of shade on both cattle and sheep ranges on the Humboldt and as a consequence the aspen range, especially along watering places, is considerably overgrazed with the result that there is no aspen reproduction. I found about the same situation on an overgrazed cattle range on the Modoc National Forest.

Observations elsewhere do not always show such marked damage to aspen from sheep grazing on range where other forage suitable for sheep is available. It is a fact, however, that overgrazing or heavy grazing by sheep will prevent a good stand of aspen reproduction. Continued overgrazing by cattle also will seriously interfere with, if it does not prevent, satisfactory reproduction.

Grazing in Relation to Fire

Hatton,⁹ in an unpublished report on grazing in relation to fire protection on the National Forests, in 1913, compiled and analyzed all available data on the subject, including carefully prepared reports from 120 forest supervisors. He summarized his conclusions as follows:

"Grazing has its relative place in fire protection and should be given due weight in protection plans by working out the proper kind and intensity of grazing according to the particular needs of local situations.

"The ideal use in general is normal grazing, or such intensity of grazing as will maintain the pastures at normal productivity. Overgrazing is justified along driveways or strategic fire lines where intensive use will result in a greater total protection to the adjoining forests. Overgrazing the forests more than this would result in more ultimate harm than good and any sacrifice of forest interests should not be made except through the assurance of greater net benefits."

⁹ Hatton, John H., *Grazing in Relation to Fire Damage on the National Forests*, 1913.

Mason, in his publication¹⁰ on lodgepole pine in the Rocky Mountains, emphasizes the importance of grazing as a means of fire protection in lodgepole forests. His statement in part is as follows:

"Besides the active measures taken to prevent and extinguish fires, such as lookout stations, telephone lines, roads and trails, patrol, and the like, certain coordinate lines of forest work may be handled in a manner to insure that the fire danger will be kept at the minimum. The most important of these in the case of lodgepole pine is the grazing of livestock, particularly sheep. In the lodgepole-pine region fire almost invariably spreads by means of grass and weeds. A grass fire travels very rapidly and soon spreads over large areas. The grass of the lodgepole-pine region becomes sun-cured early in July and dries very rapidly after summer showers which dampen other inflammable material for several days. Thorough grazing on the dangerous areas by sheep would dispose of most of the inflammable material. Old grass left over from the previous year is particularly inflammable and makes a very hot fire. Particularly heavy grazing along trails, secondary ridge tops, and certain section lines would be a means of securing fire lines at frequent intervals. When grazing in the timber, sheep trample and wear out the down litter and other debris, greatly hastening its decay."

Regarding grazing as a factor in fire prevention Sparhawk reports as follows:

"The most important benefit to the forest which can be attributed to grazing is the reduction in quantity of inflammable ground cover and the consequent decrease in fire hazard. It is not probable that the number of fires can be reduced in this way, but their intensity and consequently their size and the amount of damage done, is bound to decrease with a decrease in the quantity of fuel on the ground. This is particularly apt to be true in a forest of the western yellow pine type, where fire seldom runs in the crowns but nearly always on the ground. If the ground cover is scanty, the older timber is to a certain extent immune from serious damage by surface fires, and there is more likelihood that occasional patches of reproduction will escape destruction. Entire denudation of the soil, such as occurs on much-used bed grounds and along driveways, absolutely prevents fires from spreading in such places, but of course destroys any reproduction which may be present. Light or moderate grazing does not remove enough of the cover to stop fires, but may considerably reduce their heat and rapidity of spread and make them easier to combat. During a dry season spots where danger of fire is greatest may be grazed as closely as possible."

CONCLUSIONS FOR PRACTICAL APPLICATION

From the foregoing data I have attempted to formulate a few conclusions which will apply generally in the management of grazing on

¹⁰ Mason, D. T. Utilization and Management of Lodgepole Pine in the Rocky Mountains. U. S. Dept. Agr. Bull. 234, 1915.

timbered lands, and other conclusions which are regional only. The statements are purposely broad with a view to their practical application in the management of the National Forests.

The conclusions of general application are:

1. Regardless of sectional or local conditions overgrazing by sheep, whether due to too many stock or bad management of the stock, results in injury to tree reproduction which will seriously interfere with or prevent the establishment or reestablishment of a satisfactory stand of timber.

2. *The character of forage, the season of grazing, and the way in which the sheep are handled on the range*, each and collectively, are factors which may result in excessive injury to tree reproduction even if *overgrazing of the range* in the ordinary sense of the word is eliminated.

3. Excessive injury to tree reproduction is unavoidable on driveways, but the extent of area so injured can be kept down materially by care in the location of driveways; further, it is often possible to locate driveways so that they will be a benefit to the forest through their value as fire breaks.

4. Grazing is a factor of consideration in fire protection, primarily by decreasing the inflammable material through removal or by hastening decay.

5. Large areas have reproduced to western yellow pine, which is probably the species most injured by grazing, notwithstanding considerable injury by sheep grazing over long periods.

6. Injury to tree reproduction by cattle and horse grazing is negligible except on areas considerably overgrazed.

The following conclusions are regional:

1. (a) As a general rule forests in Idaho, Oregon, Washington, California, and perhaps Montana, Wyoming, and Colorado, will reproduce satisfactorily under grazing, provided grazing is properly regulated.

- (b) On plantations, direct seeding areas, areas which should be reproduced and are not reproducing and, perhaps, after cutting in these states, sheep grazing should be eliminated until a good stand of seedlings three years old is secured and only moderate to light grazing by sheep should be allowed thereafter until it is considered that full grazing will not result in injury which will interfere with the stand of timber desired.

2. (a) In Arizona and New Mexico, and perhaps southern Utah, areas in need of reproduction should be closed to sheep grazing until a satisfactory stand of reproduction six inches to three feet in height is secured.

- (b) Within this territory sheep should be excluded permanently from bunch-grass range in timber as far as practicable.

3. In aspen forests where reproduction of aspen is desired, sheep should be excluded for at least three years after cutting.

- APPLICATION IN GRAZING MANAGEMENT

In statement these principles or conclusions seem simple enough. Except for total protection from grazing the conclusions regarding

grazing and tree reproduction apply also to regulation of grazing for maintenance and best use of the range. They are first essentials of efficient regulation of grazing. Granting that they meet with general approval, the next step is to secure their application. It is easy to dismiss the matter by laying down the rules and ordering efficient regulation of grazing in accordance with them. When we get that far, however, we are just beginning.

Take the first general conclusion regarding overgrazing, for example. Mr. Coville recommended "grazing only to such extent that the forage crop does not decrease from year to year." Sparhawk, aside from stipulating the methods of handling the stock, recommended "grazing close enough to utilize practically all of the palatable forage." Hill's conclusion was similar to Sparhawk's. Sparhawk points out that the grazing capacity of range in western yellow pine is so variable that figures for general application even in one locality are impracticable. *In applying Rule 1, then, we are lacking in a definite standard for intensity of grazing which will be interpreted and applied uniformly by all forest officers, and we cannot substitute a measure of acres per head because of variation in range capacity.* Further, as far as I have been able to determine we have no authorized standard of what constitutes a satisfactory stand of reproduction at different ages, except in special cases such as Mason worked out for lodgepole pine. I fully realize that the requirement will vary greatly with species and local conditions. I am merely pointing out the lack of a satisfactory measure in the hands of local forest officers.

Regarding the application of general conclusion No. 2: The suitability of forage for sheep, and the season of grazing with respect to the seasonal variation in forage must be determined at least for each locality and eventually for every part of the range. This is not an easy task and at best will take time. The desired methods of handling the sheep are practicable but are not usually followed closely enough to minimize damage to reproduction unless there is close supervision of grazing.

The location of driveways so as to minimize injury to reproduction and secure the maximum fire protection requires an accurate type map or the equivalent in the way of detailed knowledge of the forest. The scheme of driveways must be thoroughly considered in connection with grazing, silvicultural and fire protection needs.

In the application of the regional conclusions we have all the difficulties outlined for 1, 2, and 3 of the general conclusions, and in addi-

tion specific data are lacking relative to location and extent of areas not reproducing satisfactorily. In practically all cases there are administrative difficulties in making changes in class or numbers of stock and in all cases there is difficulty of controlling the stock to put restrictions or changes into effect.

To put into application, then, the comparatively broad principles outlined and to overcome the difficulties is a pretty big load for local forest officers, along with a multitude of other duties, and it is the local officers who finally must do it, unless there is a change.

Taking the situation as a whole I am not surprised that in their annual reports for 1917, 60 per cent of the supervisors reported no injury to forest reproduction; 34 per cent reported slight injury or injury not serious; 2 per cent, injury more than offset by reduction in fire damage; 2 per cent, excessive injury on driveways only; and 2 per cent, injury to aspen sprouts only. On the other hand, I am not surprised that inspectors visiting the Forests should report excessive local injury or that they should report satisfactory reproduction in spite of injury from sheep grazing over a period of years.

THE FUTURE

The main reason for my consenting to discuss this subject and for taking so much time in doing so, is my feeling that the whole question should be given thorough general consideration with a view to deciding what probable difficulties will come in the future and how they are going to be met.

In the fiscal year ending June 30, 1919, a total of 2,228,778 head of cattle and horses and 7,995,963 sheep and goats were grazed under permit on the National Forests. This was an increase of 85.7 per cent in cattle and horses and 20.1 per cent in sheep and goats over the number grazed in 1907, while the increase in acreage was about 5 per cent. The National Forest ranges are approaching a fully stocked condition, some of them are overstocked; the demand for range is still far in excess of the supply; the number of permittees increased from 21,788 in 1907 to 39,152 in 1919; the average number of cattle and horses per permit in 1919 was 68 head, and for sheep and goats 1,207 head, showing that the average use is about on a "living basis," rather than greatly commercialized.

To me these figures, representing briefly the grazing situation, indicate a necessity for doing all that can be done to harmonize grazing

use and timber production by increasing efficiency of grazing regulation along all lines. To do justice to timber reproduction we must have efficient grazing regulation or reduce stock and waste forage. It is most certain that protection against grazing with resulting waste of forage will be met by protests and appeals frequently involving small holdings which supplement other forms of agriculture to barely make a living. The result of such opposition will be delay in protection measures. I do not mean to advocate sacrificing timber production to grazing. I am merely stating my honest conviction that we should be better fortified than we are at present to function properly in the task of timber production under grazing.

In accomplishing this end the following steps seem to me of importance:

1. Adopt a set of general conclusions or principles and regional conclusions or principles similar to those I have outlined.

2. With these as a basis develop a definite basic policy to govern grazing use by groups of Forests, individual Forests, or parts of Forests, taking into account such factors as species, accessibility, probable date of cutting of timber, facilities for fire protection and the needs of surrounding territory.

3. Either recognize grazing use as a part of timberland management and therefore a part of forestry in this country and take it seriously, or place a safe limit on grazing use and stick to it. The main object of this is to provide for a definite rather than a hazy teaching of this subject to men who, in future, will manage the National Forests. It may be unnecessary, but I sincerely believe not. Students of forestry soon become supervisors in charge of perhaps a million acres of land largely timbered and in large part under grazing use.

4. Provide as rapidly as possible for surveys such as Kimball and Westveld have undertaken on the Coconino and Tusayan to collect specific data as a basis for deviation from the general grazing practice in order to insure proper reproduction of forests where they are not reproducing, concentrating this work in accordance with the comparative importance of this problem by regional groups as decided upon under 2.

5. Provide for more rapid accumulation of specific data to enable efficient adjustment of grazing as to season, intensity, condition of reproduction, etc., as outlined by Sparhawk, Hill and others quoted. At our present rate it will take about 60 years to do this.

6. Provide for proper supervision of grazing, at least where the regional classification under 2 calls for efficient regulation. At present there are about 40,000 grazing permits annually, covering probably 110 million acres. I am probably safe in saying that a great many allotments are not inspected thoroughly once annually. They are in charge of a Basque herder.

7. Provide for more thorough inspection of grazing and timber reproduction within regions classified under 2 as important.

The conclusions and their discussion, as well as the suggestions given, admit of much elaboration and discussion not possible in the time available and perhaps not desirable in "sizing up" the administrative problem involved.

SPECIALIZATION VS. GENERALIZATION IN FORESTRY EDUCATION

BY R. D. FORBES

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Events of the past year have served to crystallize what appears to have been a sentiment current for some time in the profession, namely, that during the past few years forestry in this country has not made the progress which it should have made and which was augured by the success of the forest conservation movement during the first ten years of the century. It would be presumptuous for one who has been at work in forestry only six or seven years to judge of the extent to which our progress has slowed down, but taking it for granted that some slowing down has taken place, it may not be impertinent to attempt to analyze the cause. The writer does not flatter himself that he has discovered more than one or two of the probably numerous reasons for our failure to forge ahead at the same rate at which the forestry movement started out, but he does believe that it must be apparent to everyone that the youth and inexperience of the profession as a whole have had something to do with it. There is no denying that the best of native ability, trained under the most approved methods in the schools, and fired by a deep and genuine desire to be of public service, cannot make up for long experience in the world of trees and men, and that at least some of the mistakes of the professional foresters may be traced to their lack of maturity and to their inexperience. Time, and time alone, may be trusted to remedy this. But is there not another cause for our slow progress, one which lies at the very bottom of things, and which can be remedied only by conscious effort, based on careful thought? I submit that there are some fundamental errors in our forestry education which may account for our failure in latter years to build swiftly and surely upon the foundations laid by the early proponents of forest conservation in America.

The average forester engaged in administrative work, or in any other line of work not directly connected with teaching, is very apt to hesitate to express his opinion on educational matters. This hesi-

tancy arises from his realization that since his graduation, be it ever so recent, the courses of study in his old school, and in fact the entire method of teaching, may have changed so radically as to render valueless any criticism, based on his practical experience, of the course of study which he pursued in the forest school. The natural result of this has been the failure of the very men whose opinions would perhaps be worth most to their school to communicate them to the faculty as a basis for keeping the course up to date, or for moulding the system of study to meet the practical needs of the graduates. In a broader sense the forestry profession and our current literature have suffered through the failure of the administrative men to write on problems of administration. Our professional writings have been too often confined to articles of a highly technical nature, with the result that while we are fairly well informed on form quotients and the fifty-seven varieties of regulating yield, we have had very few articles on "How to Run a National Forest," "How to Secure Appropriations from an Unwilling Legislature," and other absorbing and esoteric topics. The usual reply, that such topics are not easy to write about satisfactorily only emphasizes the need for certain types of training at the forest schools and colleges, which will be later referred to.

If in the face of the above pronouncements I undertake a criticism of forest education, and some comment on its bearing on our alleged professional stagnation, it is in no vainglorious hope of being better equipped to attempt what other men have shrunk from, but in a desire to have the subject of forestry education reopened, this time more from the standpoint of the administrative man. The pages of the JOURNAL, particularly during 1918, have been well supplied with able discussions of forestry education, chiefly by teachers and men in investigative lines. Is it too much to expect that with a little urging the administrative men—State foresters as well as those in the Federal service—may now be persuaded to make themselves heard? Like a motion to adjourn, the discussion of so fundamental a subject as forest education would seem always to be in order.

The time is not so remote since, as a senior at the forest school, the writer was devoting many hours of thought and much discussion with his classmates to the question of what he was going to do upon graduation. Those were the days of fevered correspondence with State foresters (who regretted that they had "nothing immediate to offer, but

would put your name on file”), with lumber companies (which seemed curiously suspicious of his ability to be of service to them), with institutions of learning (which needed \$3,000 men, and could only afford to pay \$1,200, with inevitable results), and with others too numerous to mention. And looming over all was the “Civil Service,” that twelve-hour orgy of erudition, during which the harassed and care-worn student was required to disgorge his entire stock of technical wisdom, in return for which he might, many months later, receive a laconic statement that he had passed (or failed) the examination by .003 per cent, or thereabouts. In other words, those were the days when all worlds lay before one to conquer, and the average man had no more idea where he would be five years hence, or in what line of forestry work, than if he had never read or studied a word of forestry. Occasionally, of course, some man of maturer mind or earlier practical experience had a pretty definite idea upon graduation of the kind of work he intended to go into, and what kinds of work he would avoid, but in general the forest school graduate of a few years ago was willing to tackle almost any forestry job that came along, and work out his destiny gradually. I do not believe this situation has changed materially. This being so, what type of training will the majority of men most profit by?

In my opinion, and in this I beg to differ from what appears to be the accepted doctrine of the day, what forestry education needs is not specialization, but generalization. Forestry, more perhaps than most professions, needs men of catholicity and broad training rather than specialists. This is of course a generality. I do not mean that we have no need of men of highly specialized scientific knowledge, and that it is a mistake to afford opportunities for investigators in pure science. I do mean, on the other hand, that in the present state of development of forestry in America the demand is small for such men, compared with the need for two very different types of men—administrators, business men, if you please, and propagandists. Search your memory a moment, and compare the number of foresters of your acquaintance or knowledge who have fallen down on administrative or propaganda work, with those who have made a failure of investigation and research. Is not the latter far smaller? Are there not far more men in our profession who have come to grief at some time or other of their careers because they did not understand how to handle men, could not deal readily with the public, could not

organize and coordinate the forces which might help them to put forestry before the public, than have blundered in calculating yield, or estimating damages, or prescribing silvicultural treatment of a woodlot? I believe that most men will agree that this is so, and that it accounts in some measure at least for such recent slowing down of forestry progress as has taken place.

Now *why* is this so? It is not because administration or propaganda work takes any higher type of mind, or any greater application, or any finer personality. The administrator, the propagandist, and the scientist were moulded of the same clay, and barring exceptional cases as one must, the administrator (or public educator) might have become a scientist, and vice versa, under proper training. Under *proper training* and under *early enough training*. That is the answer, in my humble judgment. The training which is being given in our forest schools, graduate as well as undergraduate, has been such that we have turned out men capable of painstaking scientific research and æne-spun theorizing, far oftener than we have men of business training, administrative capacity, and the power to mould human opinion. European forestry might absorb such an output, for Europe has accepted forestry for these three hundred years, and has had leisure to go into matters beyond the fundamentals of public education, fire protection, conservative lumbering, etc. But America can not absorb it. We do not have the work for such men to do; on the contrary we have a great deal of work for which they have not been trained. That is why the so-called practical men are holding their own as forest supervisors and administrative officers all along the line in the Forest Service, for example, while some of the technical men who were found to be round pegs in the square holes of administrative positions have been side-tracked into positions elsewhere, ingeniously created for them by apprehensive superiors. (Some of the latter, given work of a technical character, and requiring no less ability, though of a different kind, have on the other hand retrieved earlier failures and made some of the most valued men of the profession today.) That is why three or four of the State forestry departments have made no mean records under the direction of men without professional forestry training.

Some men, particularly those who have not been to the forest schools themselves, have been quick to interpret this situation as an indictment of all technical training, and have rather taken the position that tech-

nical education for foresters is a mistake. It is an old, old argument, and one which the professional man of every kind has long been familiar with. Possibly the argument in the case of the forester has been difficult to meet successfully from the very fact that in some ways our forestry education has been at fault. The less violent partisans have undoubtedly felt that while in general forestry education has been good, it is far from being totally immune to criticism. R. C. Bryant, himself an educator, had this to say recently:¹

"It is one of the weak points of the profession that as yet we have not developed forester-economists who can speak authoritatively on the many vital problems affecting forests and forestry. The profession should contain within its ranks men who are regarded by jurists, economists, and laymen alike as authorities on cost-finding methods as related to forest products, as experts on tariff questions related to lumber, as experts on lumber distribution, and other like subjects. Why are not foresters called into consultation by courts and Government agencies on questions involving tariff legislation, export policy, lumber transportation, and like issues? It is, I think, largely because we have been content in the past to devote our attention to the problems which seem more closely related to forestry and have neglected the broader economic phases of the subject, which did not seem at the moment of so great interest or of such vital importance."

I do not know whether Professor Bryant had the forest schools specifically in mind when he wrote this, but certainly his statement fits their case. There are before me the catalogues of half a dozen representative forest schools of the United States, sent in response to investigation was not without its chastening effects. (Incidentally the investigation was not without its chastening effects. Out of some dozen schools addressed, nearly half wrote cordially to urge my matriculation.) Two of these schools offer five-year courses leading to a Master's degree, but for the present the discussion will be confined to their four-year, or undergraduate, courses. The first school requires the Bachelor of Science in Forestry to take three year-hours² of college English, three year-hours of economics or history, seven year-hours of electives, and the remainder of his course either in elementary science or in forestry courses pure and simple. School two requires four year-hours of English, one of public speaking, one of economics, and all the rest science or forestry. School three re-

¹ The War and the Lumber Industry, by R. C. Bryant, JOURNAL OF FORESTRY, February, 1919.

² By year-hour is meant one hour a week throughout the college year, exclusive of the summer term.

quires seven to seven-and-a-half year-hours of business training (such as accounting, etc.), and three-and-a-half to six hours of electives, plus science and forestry. School four requires four-and-a-half hours of English, one-and-a-half hours of public speaking, six hours of economics and history, and six hours of modern languages, which with the science and forestry make a well-balanced course, and one which should, and does, turn out extremely competent men. School five requires three hours of English, and one-and-a-half hours of economics, in addition to the sciences and forestry. School six demands three hours of English, three of economics and history, one-and-a-half hours of business training, (accounting, etc.), and four-and-a-half hours of electives, with the usual science and forestry.

Now, it is entirely possible that that school at least which required no English at all, and probably some of the others, recommend English as one of their electives. But when I peruse some of the official publications of our National and State forestry departments, which in no wise deserve better classification than among the proverbial dry-as-dust government bulletins, the suspicion arises that some of our professional men, far from electing any English courses, must have performed very indifferently indeed in such courses in their native tongue as they were compelled to take. It is to me an abiding reproach to the profession that in order to secure an editor for the only popular forestry journal in America we apparently were compelled to go outside of the profession to secure a competent man. Not only do the majority of us see no virtue in attempting to emulate such masters of scientific prose as Huxley and Spencer, who could make an exposition of the origin of chalk, or bulky volumes on the evolution of life, read like one of the six best sellers, but we are also quite indifferent to the efforts of those who do try to make forestry topics popular. For example, a series of three cleverly written and well-illustrated articles from a forester's pen were recently printed in the leading agricultural journal of this country, if not the world; the writer tells me that outside of his colleagues, whom he meets daily, precisely two professional foresters have seen fit to congratulate him upon his success. The forester responsible for a recent bulletin, patently intended chiefly for propaganda purposes, and to that end containing illustrations that are a joy forever, was rewarded by the forester reviewer with the comment that it is a "stylish" publication," and an intimation that the author trifled with the facts in the case. Is it any wonder that the forestry propaganda, at least of late years, has apparently limped

badly, and that Mr. Pinchot's dictum still holds, that "forestry is being practiced everywhere but in the woods?" It is certain that with but two schools out of six requiring public speaking, we can have little hope that the spoken word will outrun the written word in advancing forestry, little arduous as the race would have to be.

If Mr. Bryant's desire for forester-economists is to be fulfilled, we shall have to do better than the three year-hours of economics offered by two of our six schools, and the one or one-and-a-half offered by two others. The writer speaks with feeling on this point, for three hours of economics was all that he took while at college, and in spite of a reasonable degree of application he finds himself hopelessly lost when the question of Federal forest-loan banks comes up, and similar topics. He believes that the courses in business training are a step in the right direction, so far as they may serve as a substitute for economics in giving the forester a proper perspective in which to view his work. But would it be not only better, but also entirely feasible, to include under some such heading a study of what for lack of better name might be termed business psychology, so far as that subject may be taught at all outside of the great university of experience? A certain State forester has told me that in his State he considers forestry to be 10 per cent trees and 90 per cent people. Is not the average forestry course, as evidenced by the above analyses of typical undergraduate curricula, 90 or 100 per cent trees? We have taken too seriously the scientific aspects of our profession, in our forestry education, and left our forest school graduates to dig up the human relationships after graduation. We know considerable about forests, but have lately been obliged to confess that we have not paid much attention to the owners of the forests, with disastrous results. The lumbermen can scarcely be blamed for not understanding forestry when the foresters have taken so little pains to equip themselves to understand either lumbering or lumbermen. Judging from recent events, wisdom in that direction at least has not accompanied grey hairs.

In conclusion let me say that the graduate schools can take little umbrage to their souls on the score that their curricula have invariably been a material improvement upon the undergraduate forestry courses. In my poor judgment the chief advantage of the graduate course lies not in the broader curriculum, but in the ordinarily more capable instruction (the graduate schools being older, and in the beginning wealthier, have had stronger faculties), and in the mingling of somewhat older and more mature men, from several sections of the country

and from several undergraduate schools. This condition can, of course, be remedied, but I am speaking of the present situation. If it could not, there would be little argument indeed herewith to convince a man that he should spend one or two years more time and money in order to win a Master's degree. The tendency of the graduate schools is to meet the increasing competition of the undergraduate institutions by emphasizing specialization and "advanced work." If opportunities for research and specialization are necessary, as in a small number of cases they are, the graduate schools are by all means the logical place to afford them. But would not the graduate schools better serve the cause of forestry education by turning out men of broader training rather than of narrower, more highly-specialized training? Given three or four years of college English, economics, history, modern languages, psychology, public speaking and similar "cultural courses," together with the elementary science, and the post-graduate forester will be prepared to assimilate quickly and thoroughly the higher sciences and the pure forestry in his one or two years of intensive training. With such a training, coupled if possible with some practical woods experience, gained in summer vacations or even a full year out of school, the Master of Forestry should be capable of making a first-rate forester and what is perhaps equally important, a first-rate citizen.

FORESTRY MOVEMENT OF THE SEVENTIES, IN THE INTERIOR DEPARTMENT, UNDER SCHURZ

BY JEANNIE S. PEYTON

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Running back fifty years or more, to the early days of the forestry movement in this country, it is interesting to note that it was contemporaneous with considerable legislative activity in respect to timber on the public domain, initiated and spurred on by interests other than the timber conservationists of that day. Such activities, at least as they are revealed by the statute books and the histories based thereon, were undoubtedly pernicious. So much so, in fact, that that period, viewed from the standpoint of our timber interests, has come to be regarded as almost wholly and hopelessly bad. Yet such was not altogether the case, for those were not the only public timber activities of that time, nor were they by any means the most important, even though they may have left a more indelible impress on the statute books, and also on the public mind. Concurrent, therewith, in point of time, but running wholly in the opposite direction, were other legislative efforts—those of the conservationists—made in behalf of a provident timber policy. These activities, while they failed for a time, were, notwithstanding, none the less noteworthy for that reason, since, when measured rightly, the failures of any movement, particularly those suffered during the period of its inception, are frequently not less important than the success which marks its final achievement, and for which they usually pave the way. All who fought and lost in those early days of struggle to establish the movement undoubtedly won honors and deserve to share with those whose good fortune it was to fight later on and see the cause crowned with success. It is with the purpose of bringing more fully to light, and giving to it due place and prominence in the history of our forestry movement, that the stirring clash with the enemies of forestry which took place in the Interior Department when Carl Schurz sat in the Cabinet, is here chronicled.

Granted that the Interior Department and its General Land Office did during this very period, as well as subsequently, function under

mandate of law ¹ to dissipate the public heritage, nevertheless, it interposed stout resistance while the very enactments were before Congress which were later to bring the department into disrepute among the forest conservationists. And it did more than merely attempt to defeat that bad legislation. It stood out vigorously for the substitution of a provident forestry administration of the public domain. In fact, the fight maintained in that quarter throughout Secretary Schurz's entire administration constituted one of the most outstanding features of the whole forestry campaign.

Before detailing the facts it may be well to glance for a moment at certain of the attendant circumstances, more especially in respect to the twin acts of June 3, 1878, which have left the stamp of iniquitousness on this period. Fortunately, when the calamity of their enactment was impending, the Secretary of the Interior at that time was more than a mere "keeper of the timber" for the people—he was a forester at heart. Born and bred in a country where forestry had been accepted as practical, Carl Schurz measured rightly the potentialities of our forests. And, loyal American that he had ere that time become, his every instinct revolted against the violation of democratic principles involved in so shaping legislation as to admit of the spoliation of our natural resources in the interest of the powerful and unscrupulous. Grafters of every kind, great and small alike, met with short shrift at his hands. And as one who had unhesitatingly jeopardized his life to establish and defend democratic institutions in his own unhappy land (crushed even then under the heel of Prussian despotism) he was not likely to see those identical principles violated here in connection with the domain entrusted to his care, without a protest amounting in point of vigor to decisive action. In evidence of the strength of his convictions in respect to the duty of defending such institutions, may be cited the noble utterance which he, himself, has

¹ The question of the duty of executing the public timber laws as they stand upon the statute books, whether obnoxious or otherwise, was taken up and squarely faced by Secretary Schurz in his first annual report, as follows:

"That the laws are made to be executed, ought to be a universally accepted doctrine. That the Government is in duty bound to act upon that doctrine, needs no argument. There may be circumstances under which the rigorous execution of a law may be difficult or inconvenient, or obnoxious to public sentiment, or working particular hardship; in such cases it is the business of the legislative power to adapt the law to such circumstances. It is the business of the Executive to enforce the law as it stands."

recorded as the avowed creed of the one² who had been his political leader in the oppressed land from which they both fled: "But because I am a democrat, because I consider the democratic state as the only and certain possibility to banish misery from the world, therefore I also believe that when a people have once won democratic institutions they have not only the right, but also the duty to defend those institutions to the last with all means within their reach, even with musket and pointed steel."

How Carl Schurz, as Secretary of the Interior, in conjunction with his ardent supporter in the cause of forestry, General James A. Williamson, Commissioner of the General Land Office, discharged "with all means within their reach" their duty to defend the public timber rights of the people, is written in clear and stirring terms upon the records of that administration. The record is so vibrant throughout with intensity of purpose that the history of the struggle recorded there can not fail to make good reading, as one of the most vital chapters in the whole forestry movement.

For several years immediately preceding that administration the subject of the rapid deforestation of our public lands had been a matter of growing concern to the General Land Office, resulting in reports to the Secretary of the Interior recommending not only more effective measures to check the work of unlawful appropriation of public timber, but also pointing out and urging the necessity for the adoption by Congress of a total change of policy respecting the disposition of the timbered portions of the public domain, in order to insure a commensurate return of value in effecting sales of such lands or of the timber thereon. In this connection, stress was laid upon the need for provision by law to enable the immediate survey and appraisal of the lands by experts, as an essential feature of the policy proposed.

As a result of this agitation of the subject, on the very threshold of the new administration—in fact before it was more than a month old—we find Secretary Schurz, on the 5th of April, 1877, concurring in a report made by General Williamson, and directing vigorous action to compel observance of the law in respect to public timberlands. This was shortly followed up by General Williamson in his annual report

² Professor Kinkel.

³ It is well to remember that the agitation for special timber land legislation which had been under way in Congress since 1871 had not yet borne fruit in the twin acts of 1878.

for that year (1877) with a discussion of methods of dealing with depredators upon public timberlands, which concluded with the following recommendation for legislation embracing certain of the basic principles underlying a national forest policy:

"Having thus given in brief what has been done in the past and what is being done now, it remains to examine the question with reference to the measures which should be adopted in the future for protecting and preserving the timber, or for the survey and sale of the remaining timber lands. In considering this question it may, I think, be safely assumed that the laws which are now in force³ providing for the disposition of the public lands are not the best, when applied to timber lands. . . . That some distinction and separate legislation in regard to the timber lands is now necessary, will not be questioned by any person who will take the trouble to investigate the question of timber supply and its probable duration under existing laws.

"If the problem of future supply and the means necessary to secure it did not enter in, some legislation for the purpose of protecting the Government against mere pecuniary loss would be necessary. But the necessity of early adopting some policy looking to the preservation of timber for future supply is of so much greater importance that I desire to call your attention more especially to it.

"Assuming, therefore, that present laws are inadequate, either for the sale or preservation of the timber lands, the inquiry to what end should future legislation be directed is now to be considered. Shall the timber lands be surveyed and sold at one dollar and twenty-five cents per acre, or shall they be appraised and sold at a fair valuation, or shall their extent and location be ascertained, and *they be held by the Government, and the timber sold under such rules and regulations as may be provided by law, looking to a renewal of the forest by a careful preservation of the young timber*, as is provided by law and carried into effect in some of the states of Europe. . . . (Italics are the author's.)

"All past history shows only two successful methods of preserving timber in densely populated countries; the one, by the Government retaining the title to the land and exercising a watchful supervision over the sale and disposition of the timber, as in Germany, where large revenues are annually derived from this source; the other, through law of entail, as in England, by means of which a landed aristocracy holds the soil and has the aid of the strength and [of] well executed laws to enable the preservation of the timber. . . .

"In an official report, which must necessarily be brief, a subject of the interest and importance of this cannot be discussed at such length or in such manner as to present all the arguments as to what should be done. The disastrous climatic effect resulting from the removal of forests might be urged separately as a reason for their preservation, if the scope or extent of an official report would warrant it. As I cannot enter this field of argument, for the reason above given, I will venture only to express the hope that you may be able to secure investigation by Congress into this very important subject. . . . From the examination I have been able to give this question, I have concluded to recommend to you:

"1. That Congress should, by proper legislation, withdraw all lands chiefly valuable for pine timber from the operation of the homestead and preemption laws, and from all manner of sale or disposition except for cash at a fair appraised value, to be ascertained in such manner as Congress may provide, under the direction of the Secretary of the Interior.

"2. That the Secretary of the Interior be authorized by law to sell at just and fair valuation, to be ascertained as Congress may direct, timber from the public lands in mining districts where it would be contrary to existing laws to sell the land by legal subdivisions, or in any manner except as provided in the mining laws now in force; also that he be authorized to sell the timber upon any unsurveyed land, not mineral, when needed for actual settlement before the public surveys are extended over such lands. This legislation is necessary, pending any other that may be deemed best by Congress.

"3. That Congress be requested to enact a law *providing for the care and custody of such timber lands as are unfit for agriculture, and for the gradual sale of the timber growing thereon, and for the perpetuation of the growth of timber on such lands by such needful rules and regulations as may be required to that end.* That Congress be requested to enact such laws as may be necessary for the appraisement and sale of such timber lands as it may deem best to sell; also providing for the care and custody of such lands until such time as they are sold. . . ." (Italics are the author's.)

This proposal to broaden out the merely protective timber policy of that day into a definite, systematic forest administration, was promptly taken up by Secretary Schurz, and handled with vigor, in his annual report for the same year, to the following effect:

"The rapidity with which this country is being stripped of its forests must alarm every thinking man. . . . But the government can do two things: (1) It can take determined and, as I think, effectual measures to arrest the stealing of timber from public lands on a large scale, which is always attended with the most reckless waste; and (2) it can preserve the forests still in its possession by keeping them under its control, and by so regulating the cutting and sale of timber on its lands as to secure the renewal of the forest by natural growth and the careful preservation of the young timber. . . .

"To avert such evil results [from wasteful destruction of the forests], I would suggest the following preventive and remedial measures: *All timber lands still belonging to the United States should be withdrawn from the operation of the preemption and homestead laws, as well as the location of the various kinds of scrip.* (Italics are the author's.)

"Timberlands fit for agricultural purposes should be sold, if sold at all, only for cash, and so graded in price as to make the purchaser pay for the value of the timber on the land. This will be apt to make the settler careful and provident in the disposition he makes of the timber.

"A sufficient number of government agents should be provided for to protect the timber on public lands from depredation. . . .

"Such agents should also be authorized and instructed, under the direction of the Department of the Interior or the Department of Agriculture, *to sell for the United States, in order to satisfy the current local demand, timber from the public lands under proper regulations, and in doing so especially to see to it that no large areas be entirely stripped of their timber, so as not to prevent the natural renewal of the forest.* . . . (Italics are the author's.)

"While such measures might be provided for by law without unnecessary delay, I would also suggest that the President be authorized to appoint a commission, composed of qualified persons, to study the laws and practices adopted in other countries for the preservation and cultivation of forests, and to report to Congress a plan for the same object applicable to our circumstances.

"I am so deeply impressed with the importance of this subject, that I venture to predict, the Congress making efficient laws for the preservation of our forests will be ranked by future generations in this country among its greatest benefactors."

As probably further indicating the zeal with which Carl Schurz, as a cabinet officer, pursued this subject, it is interesting to note that this report upon the matter was sufficiently pressed upon the attention of the President to cause its recommendations to be made one of the features of President Hayes' first annual message to Congress. We find that message stating as follows:

"I invite the attention of Congress to the importance of the statements and suggestions made by the Secretary of the Interior, concerning the depredations committed upon the timberlands of the United States, and the necessity for the preservation of the forests. It is believed that the measures taken in pursuance of the existing law to arrest these depredations will be entirely successful if Congress, by an appropriation for that purpose, renders their continued enforcement possible. The experience of other nations teaches us that a country cannot be stripped of its forests with impunity, and we shall expose ourselves to the gravest consequences unless the wasteful and improvident manner in which the forests in the United States are destroyed be effectually checked. I earnestly recommend that the measures suggested by the Secretary of the Interior for the suppression of depredations on the public timberlands of the United States, for the selling of timber from the public lands, and for the preservation of forests, be embodied in a law; and that, considering the urgent necessity of enabling the people of certain states and territories to purchase timber from the public lands in a legal manner which at present they can not do, such a law be passed without unavoidable delay."

This start-off, so early in the administration, left no room to doubt that both the Commissioner of the General Land Office and the Secretary of the Interior not only deemed it their duty to deal effectively with depredators upon the public domain, but saw with equal clearness the importance of securing a provident forest policy, shaped along

constructive lines, to the end that that domain might be dedicated to and developed for the benefit of all the people. This was even more clearly brought out a little later, when, seeing their purpose in a fair way to be defeated, they both rose in wrath to vanquish and root out the despoilers of the people's heritage, and at the same time to urge again the enactment of a bill to inaugurate a national forest policy. Nor did they stake their chances wholly upon mere general recommendations. Concrete action took form in the shape of a bill, drafted in the General Land Office, to embody substantially the forestry legislation regarded as desirable by the Interior Department. This bill, with slight amendments, was introduced on January 28, 1878, as Senate Bill 609. The following brief summary of its leading features will sufficiently indicate both its purpose and the general scope of its provisions:

SENATE BILL NO. 609 (45TH CONG., 2D SESS.)

Summary of provisions.

A.—*Purpose*.—All public lands chiefly valuable for timber are withdrawn thereby from sale or other disposition, except as therein provided, and held, with a view to: (a) Preventing waste and destruction by fire or other causes; and (b) Providing for the gradual sale of such timber thereon as may be advisable, in connection with the preservation of the young timber, and the continuous restoration and reproduction of the forests, under official regulation.

B.—*Administrative Features*.—Office of Forester created; and provision made:

1. For the appointment, under bond, of a sufficient number of foresters, qualified for the office by both education and occupation; and for their performance of duties specified therein or in regulations thereunder.

2. For the administration of the act by the Department of the Interior, through the General Land Office.

3. For the disposal, by private entry, of non-mineral, agricultural lands, which are not chiefly valuable for timber except in the case of small isolated tracts, after having been first offered at public sale.

4. For appraisal of timbered lands, including both the soil and the timber.

5. For appraisal, advertisement, and sale of timber, under conditions regulating in express terms the matter of prices, and also prescribing a diameter limit, with a view to insuring regulation of cut.

6. For seizure and sale of timber unlawfully procured from public lands, and for due recovery and accounting for, under regulations by the Secretary of the Interior, of all penalties and forfeitures incurred for unlawful cutting and taking timber from public lands.

7. For the disposition of moneys accruing from sales of public timberlands and public timber.

8. For carefully guarding, by the foresters, timber on the public lands, to prevent waste by trespass or fire; and for both criminal and civil liability for wilfully or negligently causing the firing of woods, prairie, or grounds which are public lands of the United States.

9. For procurement of needed timber supplies by bona fide homestead and pre-emption settlers, and by claimants thereunder, through entry of small timbered tracts, at \$1.25 per acre.

10. For an appropriation for carrying the provisions of the act into effect.

This bill stands out prominently as a landmark in the history of our forestry movement, since it is distinguished as being not only the initial effort on the part of the Interior Department to secure a forestry administration, but constituted, in fact, the first truly comprehensive bill of that nature introduced in Congress.⁴

Notwithstanding the urgent need for the enactment of some such measure, the bill was practically ignored by Congress, beyond referring it back to the General Land Office, in nearly the same form, for report thereon, and it ultimately died without being reported out of committee, in spite of the fact that the Commissioner of the General Land Office and the Secretary of the Interior both again reported in favor of it.

This same paralysis of action did not, however, extend to the two above mentioned undesirable bills which culminated in the twin acts of June 3, 1878, commonly known as the "Mineral Land" act and the "Timber and Stone Land" act. While the proposed forestry measure slept in committee, these two timber bills were taken up, debated and passed, and sent on in due course to the President for signature. This action brought the Commissioner of the General Land Office swiftly into the field again, in an effort to defeat the bills, when called upon to report thereon. The record shows that, in the case of the Timber and Stone Land bill, he was requested "to report whether any reasons exist why the President should not approve it." His response was an unqualified denouncement of both measures as being vicious legislation, for reasons which are largely quoted in the following excerpts from statements by the Secretary of the Interior. In the face of these adverse reports both measures became law within a week.

⁴The claim that has been made in behalf of a bill previously introduced in 1872, H. R. 2197, that it was "The first real and comprehensive forestry bill," would seem to be overdrawn, in view of the fact that that bill was in reality merely a timber culture measure, with no provision whatever for the establishment of a forestry administration, or for the withdrawal and development of the timbered public domain in the interests of the public at large.

In commenting upon this course of action Secretary Schurz did not hesitate to deal with the situation with vigor. In his report for that year he has placed both himself and the Commisisoner of the General Land Office of record on the subject, as follows:

"In my last annual report I called attention to the necessity of rigorous measures for the suppression of depredations upon the timberlands of the United States. . . . But we can not close our eyes to the fact that anything like complete success in suppressing these unlawful practices is impossible, unless the efforts made by this department for the protection of the public property meet with hearty cooperation on the part of the legislative branch of the government. Actual experience enables me to say that the want of such cooperation has been and will always be an encouragement to the depredators to persist in their lawless operations and to defy the authorities.

"As to the importance of this subject I shall add but little to what I said in my last annual report. The disastrous consequences which always follow the destruction of the forests of a country are known to every well-informed man. These consequences will inevitably come upon us in a comparatively short period of time, considering the rapidity with which the timber growth of this country is being swept away, unless legislation be adopted systematically to arrest this indiscriminate spoliation. In accordance with the suggestions which, in this respect, I offered in my last annual report, a bill was introduced in the Senate (Senate bill No. 609) which provides that all timber-bearing lands, chiefly valuable for the timber upon them, shall be withdrawn from sale or other disposition under existing laws, and be held by the government with a view to preventing indiscriminate destruction and waste, and to the preservation of the young timber and the reproduction of the forests. The bill further provides ample means by which settlers on the public lands and miners can procure timber and firewood to supply their wants, with or without the soil, at minimum rates. It also provides for the sale of timber at reasonable prices for manufacturing purposes and for export. It finally provides for the appointment of a number of officers to execute its provisions under the direction of this department.

"While I have no doubt that this bill may be improved in many respects, I adhere to the opinion that it is practicable and that its enactment into a law and its faithful execution would bring a large revenue into the Treasury, while averting from this country very disastrous experiences and securing great and lasting benefits to our people. This bill was not acted upon at the last session of Congress, and I again invite to it that attention which the importance of this great public interest merits.

"While no legislation applicable to all parts of the country with regard to this subject was had, two bills of a local character were passed. . . .

"In the opinion of the Commissioner of the General Land Office [in letter to Secretary Schurz, dated May 27, 1878], which is on record in this department, these two acts are more calculated to hasten the destruction of the forests in the States and Territories named than to secure the preservation of them. . . .

"Of this act [the Mineral Land act] the Commissioner of the General Land Office, in a letter addressed to the Secretary of the Interior [May 27, 1878], expresses the following opinion:

'It is a fact well known that while almost all the timber-bearing land in those States [Colorado and Nevada] and all the Territories, except Dakota and Washington, is regarded as mineral, only a small portion is so in reality. The effect of this bill will, in my opinion, be to prevent the survey and sale of any of the timber lands, or the timber upon the lands, in the States and Territories named, thus cutting off large prospective revenues that might and should be derived from the sale of such lands or the timber upon them. It is equivalent to a donation of all the timber lands to the inhabitants of those States and Territories, which will be found to be the largest donation of the public domain hitherto made by Congress. This bill authorizes the registers and receivers of the land offices in the several districts in which the lands are situated to make investigations without any specific directions from the Secretary of the Interior or the Commissioner of the General Land Office, to settle and adjust their own accounts, and retain from the moneys coming into their hands arising from sales of lands such amounts as they may expend or cause to be expended. This method will be found exceedingly expensive and result in no good. Experience has shown that the machinery of the land offices is wholly inadequate to prevent depredations.'

"The 'Rules and Regulations' issued in pursuance of the first section of this act are to be found in the report of the Commissioner of the General Land Office, herewith presented. These rules, drawn up 'with a view to and the intention of preserving the young timber and undergrowth upon the mineral lands of the United States, and to the end that the mountain sides may not be left denuded and barren of the timber and undergrowth necessary to prevent the precipitation of the rain-fall and melting snows in floods upon the fertile arable lands in the valleys below, thus destroying the agricultural and pasturage interests of the mineral and mountainous portions of the country,' make it the duty of registers and receivers to see to it that trespassers upon timber lands, not mineral, be duly reported, that upon mineral lands only timber of a certain size be cut, and that young trees and undergrowth be protected, and that timber be cut only for the purposes mentioned in the act. These 'Rules and Regulations' will be enforced with all the power left to this department to that end, in order to save what may be saved. But I deem it my duty to call attention to the fact that, as set forth by the Commissioner in the letter above quoted, the machinery of the land offices is utterly inadequate to accomplish the object in view.

"After a careful consideration of the above-named act and its probable effects, I venture the prediction that the permission given the inhabitants of the States and Territories named therein, to take timber from the public lands in any quantity and wherever they can find it, for all purposes except export and sale to railroads, will be taken advantage of, not only by settlers and miners to provide economically for their actual current wants, but by persons who will see in this donation a chance to make money quickly; that it will stimulate a wasteful consumption beyond actual need and lead to wanton destruction; that the machinery left to this department to prevent or repress such waste and destruction through the enforcement of the rules above mentioned will prove en-

tirely inadequate; that as a final result in a few years the mountain sides of those States and Territories will be stripped bare of the timber now growing upon them, with no possibility of its reproduction, the soil being once washed off from the slopes, and that the irreparable destruction of the forests will bring upon those States all the calamities experienced from the same causes in districts in Europe and Asia similarly situated.

"It appears to me, therefore, that the repeal of the above-named act, and the substitution thereof of a law embodying a more provident policy, similar to that of the above-mentioned Senate bill No. 609, is in the highest degree desirable. If the destruction of the forests in those States be permitted, the agricultural and pasturage interests in the mountainous regions will inevitably be sacrificed, and the valleys in the course of time become unfit for the habitation of men.

"The act for the sale of timber lands in the States of California, Oregon and Nevada, and in Washington Territory, passed by Congress at the last session, is, in a letter addressed to this department [under date of May 27, 1878], commented upon by the Commissioner of the General Land Office in the following language:

'It is a bill of local and not general application to the timberlands of the United States, and adds one more to the already numerous special acts for the disposal of the public domain. The price fixed is too low, as much of the land is worth from five to fifty dollars per acre.

'Under the provisions of the bill the timber lands will, in my opinion, be speedily taken up and pass into the hands of speculators, notwithstanding the provisions to prevent such result. The soil should not be sold with the timber where the land is not fit for cultivation. Only the timber of a certain size should be sold, and the soil and young timber retained with a view to the reproduction of the forests. The bill should have limited the sale of the lands to persons who have farms and homes within the State or Territory, and it ought to have required the purchasers to show affirmatively that they had need of timber for domestic uses.

'The last clause of the second section will permit any person applying for a tract of timber land and securing a certificate from the register, to sell his right and interest therein immediately, and the purchaser, although it may have been obtained by perjury, may be entitled to a patent for the land.

'Section 5 provides that any person prosecuted under section 2461 of the Revised Statutes of the United States, may be relieved of the penalty by the payment of two dollars and fifty cents (\$2.50) per acre for the land trespassed upon. This is objectionable, for the reason that the penalty fixed is altogether inadequate, and does not require the payment of costs of prosecution, which are often greater than the penalty to be collected. It should require that the trespasser should pay for the entire subdivision trespassed upon.

'There can be no doubt that if this bill becomes a law it will be taken advantage of, by persons who want to make money quickly, to acquire the timber lands under its provisions at a very low price, and strip the mountain sides of their forest growth as rapidly as possible. How disastrous such a result will be to these States and Territories need not be detailed here.'

"I fully concur with the Commissioner of the General Land Office in his opinion thus expressed.

"The traditions of a time are still alive when the area covered with virgin forest in this country was so great that the settler might consider the trees on the land he occupied as a mere difficulty to be overcome and to be swept out of

his way. But circumstances have been very materially changed. We are now rapidly approaching the day when the forests of this country will no longer be sufficient to supply our home wants, and it is the highest time that the old notion that the timber on the public lands belongs to anybody and everybody, to be cut down and taken off at pleasure, should give way. A provident policy, having our future wants in view, can not be adopted too soon. Every year lost inflicts upon the economical interests of this country an injury, which in every part of the country will be seriously felt, but in the mountainous regions threatens to become especially disastrous and absolutely irreparable. We ought to learn something from the calamitous experiences of other parts of the world. If the necessity of such a provident policy be not recognized while it is time, the neglect of it will be painfully appreciated when it is too late. I am so deeply impressed with the importance of this subject, that as long as I remain entrusted with my present duties I shall never cease to urge it upon the attention of Congress."

That this promise was made good is evidenced in his next annual report by the following repetition of his previous appeals:

"In my last annual report I discussed the inadequacy of the laws enacted by the last Congress 'Authorizing the citizens of Colorado, Nevada, and the Territories to fell and remove timber on the public domain for mining and domestic purposes,' and providing 'for the sale of timber lands in the States of California and Oregon and in Washington Territory.' The opinion I then ventured to express, that the first of these acts would be taken advantage of not only by settlers and miners to provide economically for their actual current wants, but by persons who would see in this donation a chance to make money quickly; that it would stimulate a wasteful consumption beyond actual need and lead to wanton destruction, and that the machinery left to this department to prevent or repress such waste and destruction through the enforcement of rules to be made by the Commissioner of the General Land Office would be found insufficient for that purpose, has already in many places been verified by experience; also the predictions made by the Commissioner of the General Land Office with regard to the effect of the second one of the above named acts. Referring to what was said about these laws in my last annual report, I repeat my earnest recommendation that they be repealed, and that more adequate legislation be substituted therefor.

"It is by no means denied that the people of the above-named States and Territories must have timber for their domestic use as well as the requirements of their local industries. Neither is it insisted upon that the timber so required should be imported from a distance, so that the forests in those States and Territories might remain intact. This would be unreasonable. But it is deemed necessary that a law be enacted providing that the people may lawfully acquire the timber required for their domestic use and their local industries from the public lands under such regulations as will prevent the indiscriminate and irreparable destruction of forests, with its train of disastrous consequences. It is thought that this end will be reached by authorizing the government to sell

timber from the public lands principally valuable for the timber thereon, without conveying the fee, and to conduct such sales by government officers under such instructions from this department as will be calculated to prevent the denudation of large tracts, especially in those mountain regions where forests once destroyed will not reproduce themselves. I have no doubt that under such a law, well considered in its provisions, the people of those States and Territories would be enabled to obtain all the timber they need for domestic as well as industrial purposes at reasonable rates, and that at the same time the cutting of timber can be so regulated as to afford sufficient protection to the existence and reproduction of the forests, which is so indispensable to the future prosperity of those regions. I venture to express the opinion that the enactment of such a law has become a pressing necessity, and can not much longer be delayed without great and irreparable injury to one of the most vital interests of the people. I therefore again commend to the consideration of Congress the bill introduced as Senate bill No. 609 in the last Congress.

"The subject of the destruction of forests by fire also calls for early and earnest attention. In most, if not all, of the States where timber lands are in private possession, the setting of fires in them is made a highly penal offense by statute. But there is no law of the United States providing specifically for the punishment of such offenses when committed on the public lands. . . . I therefore repeat the recommendation made in my first annual report, that a law be enacted prescribing a severe penalty for the willful or negligent setting of fires upon the public lands of the United States, and also for the recovery of all damages thereby sustained. . . .

"I would also repeat the recommendation made in former reports that the President be authorized to appoint a commission, composed of qualified persons, to study the laws and practices adopted in other countries for the preservation and cultivation of forests, and to report to Congress a plan for the same object, applicable to our circumstances. The time is fast approaching when forest-culture will be to the people of the United States as important a question as it is in older countries; and then it will be a subject of painful wonder to thinking men, how it could have been so long neglected."

Later, Carl Schurz, when closing his career as Secretary of the Interior, in making his final annual report took up the subject again, passed in review his whole course of action, placing it in sharp contrast with the failure of Congress to support him with needed legislation, and then concluded with a word of warning directed to Congress—a warning which, it is interesting to note, carried as much of an appeal as a reproach. This final spur to action reads, in part, as follows:

"In my first annual report I had the honor to present to you in 1877, and every successive year thereafter, I invited attention to the extensive depredations committed on the timberlands of the United States, and the rapid and indiscriminate destruction of our forests, especially in the South and in the States and Territories of the West. Referring to the warning example fur-

nished by other parts of the world, where the disappearance of the forests had been followed by the most deplorable consequences: the drying up of springs; the irregularity of the water supply in navigable rivers; the frequency of destructive freshets and inundations; the transformation of once productive and flourishing agricultural districts into barren wastes, almost uninhabitable to man—I showed that the same results would inevitably befall certain parts of this country, if so short-sighted and reckless a practice be persisted in as is now prevailing. I set forth as a universally acknowledged fact that especially in our mountainous regions the stripping of the slopes of their timber would be an irreparable injury, inasmuch as the rainfall and the water from melting snows would wash down the soil, transform brooks and rivulets running regularly while the forests stand, into raging torrents at certain seasons, and sweeping masses of gravel and loose rock into the valleys below, apt to render them incapable of cultivation, while on the mountain sides the forests once destroyed would in most cases never grow up again. . . . Whatever our success in this respect [dealing with depredations upon public timber] may have been so far, it is certain that the evil will spring up again if the efforts of the government to arrest it should be in the least relaxed in the future, or if Congress should fail, by leaving the laws of the country in their present condition, to show an active sympathy with this policy. To that want of proper legislation I have each successive year called attention in my reports to you, as well as by direct appeals to Congress. The main features of the legislation urged by this department are very simple. They consist in two propositions: First, that *the government should be authorized to sell timber from lands principally valuable for the timber growing upon them*—that is to say, not agricultural nor mineral—at reasonable, perhaps even at merely nominal, rates to supply all domestic needs and all the wants of local business enterprise, as well as of commerce, the latter so far as compatible with the public interest; and, secondly, that *these sales of timber be so regulated as to preserve the necessary proportion of the forests on the public lands from waste and indiscriminate destruction*. Such a policy can, in my opinion, be carried out without great cost, with a simple machinery, and in perfect justice to the wants of settlers and the business enterprises of the country. It is virtually the policy proposed to Congress by the Public Lands Commission in the report and the bill submitted to Congress at its last session. (Italics are the author's.)

"I would also urge once more upon Congress the importance of the passage of a law, repeatedly recommended in my reports, prescribing a severe penalty for the willful, negligent, or careless setting of fires upon public timberlands of the United States, and also providing for the recovery of damages thereby sustained. . . .

"The question of the preservation of forests in just proportion to the area of the country is engaging the attention of prudent men in every civilized nation. By competent authorities it is estimated that this proportion should be about one-fourth of the whole. In some foreign countries the injury caused by the barbarous ignorance and improvidence of past times has become already too great to be repaired, and the evil consequences are keenly felt. In the United States the consumption of timber is enormous and rapidly increasing. It is in

the nature of things that where timber is taken from the public lands without restraint the process is attended with the most reckless waste. No attention is paid to the preservation of young trees or of anything that is not immediately used. What is looked upon as everybody's property is apt to be in nobody's care. Thus, our forests are disappearing with appalling rapidity, especially in those parts of the country where they will not renew themselves when once indiscriminately destroyed. Like spendthrifts, we are living not upon the interest but upon the capital. The consequences can easily be foreseen. They will inevitably be disastrous, unless the Congress of the United States soon wakes up to the greatness of the danger and puts this ruinous business upon a different footing by proper legislation, either according to the principles advocated by this department and the Public Lands Commission, or upon others that may be found equally effective. The action of the government will apply only to the public lands; but those portions of the country in which the great body of the public lands is situated stands most in need of speedy and energetic action. I have considered it my duty to call attention to this subject upon every proper occasion, and that duty has been performed. All further responsibility will rest with the legislative branch of the government. It is to be hoped that the voice of warning will be heeded before it is too late."

With this significant challenge to Congress, Secretary Schurz closed this record of his efforts to secure for his adopted country a national administration of its forests.

Viewed now in retrospect, from this distance, the whole incident stands in clear relief as an epoch-making struggle, waged in behalf of a cause then but little known, or heeded to any great extent except by its opponents. So little headway had the movement made, in fact, up to that time, that the bill drafted in the Interior Department may be said to have fairly blazed the way in respect to submitting, for action by Congress, a measure making provision for the administration of our forests. Yet, so well did it do its work of outlining basic principles that, in looking back upon it in the light of our present experience, it stands pre-eminently as the preliminary survey in our work of laying out the lines of the policy ultimately adopted. Should any doubt be entertained on this point, it will be well to measure that bill against all others previously presented to Congress on the same general subject of forest conservation, and then turn and compare it with our present twentieth century concept of a working basis for a forest policy. Carl Schurz's bill of the seventies stands the test.

Accordingly, when later on in the nineties, the movement was in due course brought to success and signalized a victory, it should be remembered that it was not a victory of any one, but of many—a culminating victory—shared in by one and all alike who, through the preceding years, had taken a part in the slow-going process of molding popular thought along the lines of the movement.

And it may also be well to add in conclusion that when history-making action, such as the above, has been imprinted upon the movement by men of such stamp as Carl Schurz and James A. Williamson, and moreover, in characters so vigorous and clear-cut as to fairly silhouette the two men upon the background of forestry, due recognition of such services undoubtedly constitutes a debt of honor.

THE RELATION OF INSECT LOSSES TO SUSTAINED FOREST YIELD

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It is the purpose of this paper to present the insect problem from the broader standpoint of its relation to forest management, rather than the narrower one of a special protection problem. We must view this whole subject of insects and their work in the same relation that we view our other forest activities, such as timber sales, fire, grazing, etc., in their ultimate relation to the perpetuation and improvement of the forest. It is believed that in the past the subject of insects has not received the attention of foresters in this country to the degree that it should have, largely because it has been considered as lying within the province of entomology rather than forestry, and secondly, because lack of funds has made extensive and sustained efforts at control impossible. Losses from insects are more insidious than losses from fire, and the destruction of a few trees here and there throughout the stand, while in the aggregate amounting to a large loss, are apt to pass unnoticed until they have assumed spectacular proportions. We have in the past rarely, if ever, made any effort to control infestations in the endemic state, but have usually waited until they have assumed alarming proportions. It seems to me that this is an illogical procedure and that a corollary in our fire problem would be to allow small fires to go unfought until they had enlarged to vast conflagrations. These remarks are not intended as a criticism of policy, as it is realized that the only funds which have been available in the past have been obtained through sacrifice of other activities. It is felt, however, that as the administration of our timber resources becomes more intense, the insect problem must receive more study and attention.

In a subject of such large proportions, it is necessary to confine the discussion to some particular phase or problem, and I have therefore undertaken to review the situation as it exists in our stands of western yellow pine. Not only is it our most important problem from the standpoint of insect control, but it is also the problem of other administrative units throughout its wide range, from Arizona and New Mexico to

British Columbia. As a basis for future discussion it seems well to give a brief résumé of conditions reported throughout the wide range of this species.

Probably the most comprehensive effort ever made to determine the losses due to insects in the western yellow pine type was the insect survey made by the Forest Service and the Bureau of Entomology during the summer of 1917 in California. It was ascertained from this survey that the average annual loss from insects far exceeded the average annual loss from fire. Men familiar with conditions in Arizona, New Mexico, Oregon, Montana, and elsewhere throughout the type in the United States report either evidences of past serious losses represented by large amounts of standing dead timber scattered throughout the stand, or of active infestation taking its toll from these stands year after year. J. M. Swain, of the Canadian Bureau of Entomology, in his bulletin, "Canadian Bark Beetles, Part II," comments upon past serious losses and present widespread infestation in the pine stands of southern British Columbia.

In this State (Colorado) we are faced by widespread infestation throughout the San Juan, Montezuma, and Durango Forests, with reports of other infestations of possibly not so alarming an extent from other Forests on which the species is present. On areas in the Forests above mentioned on which intensive work or examinations have been made we find the annual loss running from 2 to 5 per cent of the stand per annum, and in one or two places on the Durango as much as 60 per cent of the stand by volume killed within the past few years. In this connection it may be well to state that the per cent of the stand killed in any one year in the southern pine belt seems to run considerably higher than in the stands in the Pacific Coast belt of western yellow pine.

From observations made the past summer the problem of the protection of our stands of western yellow pine in the Rocky Mountain region is almost entirely an insect problem after the seedling and sapling stage has been passed. In the course of the work on the Dolores Timber Survey project on the Montezuma Forest from May to November, I had the opportunity of examining thousands of dead trees of western yellow pine. Without exception, on all trees which had not been subsequently severely burned, I was able to attribute the death to work of *Dendroctonus* beetles, through the identification of the characteristic pitch stain and surface grooving of the wood. Moreover, where trees were found to be dying in nearly every case there was un-

mistakable evidence that they were then infested with *Dendroctonus* species, so that it is logical to assume that the standing dead timber on the area is a record of past losses from insect infestations.

The summary for the work on this project shows over 5,000,000 feet of merchantable dead timber after applying a cull per cent of approximately 40 per cent for the whole project, or a gross volume of over 8,500,000 feet in trees which have been killed so recently as to be still merchantable. In addition a total of 20,437 dead snags are reported whose death must also be ascribed to the same agency. The average volume for all live trees on the project was found to be 656 board feet, and assuming the same average gross volume for the snags gives a figure of 13,500,000 which, when added to the gross volume of merchantable dead, gives a grand total of 22,000,000 as the evident loss by insects in this block alone. It is difficult to estimate the number of years' losses represented by this figure, but it is believed that 25 years is a conservative figure. Many trees killed will not stand this long, but on the other hand, some will exceed this period, so that the two should offset each other. Yellow pine of the size and quality found on the project is usually about 300 years old. The loss from insects during the life of the stand can therefore be obtained approximately by multiplying the loss attributed to 25 years by 12, which gives 264,000,000. The volume of standing green found on the area was 292,000,000 feet, and the difference 28,000,000, assuming that the present stand represents the average growing stock that has existed on the area, may be charged off as losses resulting from fungi weakened trees blowing over, trees destroyed by the mechanical action of lightning, etc. In other words, during the life of the stand 90 per cent of the trees by volume will be killed by insects and 10 per cent by other causes.

It will be noted that the foregoing figures indicate an average annual loss of about one-third of one per cent per annum over a long period of years, which is considerably less than the figures for annual loss now occurring in some of our stands. This brings us to the discussion of the variation in the annual losses. It is a well recognized fact that insects have always been with us, and that losses rise and fall of their own accord without control operations. It is, therefore, of great importance to the forester to determine, if possible, if these variations have a periodicity, as such a determination would greatly aid in establishing the proper time for the institution of control measures. I am not referring to such widespread destruction as occurred in the Black

Hills in the late nineties and the early part of the twentieth century, as this infestation in its severity and extent seems to have been a law unto itself, and there is no record of any other one comparable to it. It is interesting to note that for *Dendroctonus Brevicomis* infestation in western yellow pine in California and Oregon it has been tentatively demonstrated that the cycle of infestation is eight years. That is, given an endemic infestation in a stand, the amount of infestation will increase greatly for a period of four years, and then recede for a like length of time. Observations on specific stands have not been conducted long enough to determine whether there is a regular progression of these maximum and minimum infestations, or whether after having completed a cycle of eight years the endemic or normal infestation may continue for a variable number of years before progressing to a new peak. Miller,¹ as the result of observations on the Rouge River Area in southern Oregon, says: "The annual loss may run as high as 3½ per cent of the stand at the height of the epidemic, and does not exceed one-half of 1 per cent of the stand during the low point." My observations in southern Colorado lead me to believe that our maximums are higher than the above figures, and our minimums lower, or in other words, that our losses when they do occur, are much more likely to be concentrated within a period of a few years of great intensity.

One other point in regard to the habits of *Dendroctonus* species of great importance is the distance of flight of the swarming broods. In spite of the fact that they have been long under observation, this is still a mooted point, there being two widely divergent views held by entomologists, the first that their flight is rather limited, and the other that they may fly 20 miles or more.

Speaking generally, much of the control work undertaken to date has not been entirely successful. Areas treated for a year or two and then abandoned have in the course of years become reinfested to a degree equal to the original infestation that caused the institution of control measures. Two reasons are offered for this—the first, that the area covered was not sufficiently large, so that reinfestation took place from the sides and surrounding country, and the other, that reinfestation took place from small centers of infestation left within the area, such centers consisting of individual or small groups of trees which were left through the control operations not extending over a

¹ J. M. Miller, Ashland Experiment Station, Bureau of Entomology, Ashland, Oregon.

sufficient period of years to completely eradicate the insects causing the damage. The determination of the flight habits of the insects belonging to this genus is, therefore, an important point for solution.

Our present silvicultural efforts looking ultimately to bringing our forests under sustained yield are largely confined to the removal of the present stands of mature and overmature timber in which the annual losses equal or exceed the increment with the idea of substituting thrifty growing stock. It has been shown that insect enemies are almost entirely accountable for the dissolution of stands of western yellow pine, and so far as possible cutting operations should, therefore, be directed toward the removal of timber from those stands in which present infestation is at its worst.

The manner in which this cutting is undertaken will have an important bearing on the life history of the succeeding stand, the stand which we hope to bring under management. If the actual infestation present is not reduced by the cutting operations it necessarily follows that the proportionate loss in the reserved stand after cutting will be greater than the ratio of the loss before cutting was to the uncut stand. Investigation is urgently needed to determine what, if any, relation exists on western yellow pine timber sale areas between the disposal of brush, logging debris, cull logs, etc., and subsequent infestation in standing timber and reproduction. At the Ashland conference last November there was a general agreement among the men present that the losses in the reserved stand on western yellow pine sale areas was a real problem in Oregon, California, Arizona, and New Mexico. It will be noted that Colorado is omitted from this summary, as our observations, or possibly lack of observations, have not shown this subject to be a serious one. It does not seem to me that we are immune to a condition which is so widespread, and I believe an examination of the cuttings made in this type may show our losses to be greater than we now suppose.

The impression seems quite general that our insect losses are due to the maturity of the stands, and that with the removal of the present overmature timber and the substitution of a young and thrifty stand our losses will automatically decrease. If such is our conclusion I am afraid we are going to be disappointed. Unfortunately the *Dendroctonus* beetles do not use a nice discrimination in the selection of trees they attack. It is true that they do seem to have a propensity for selecting fresh lightning-struck trees, but they by no means confine their activities to trees in this condition, even where the supply is large.

In our overmature stands we find the proportion of thrifty "black-jacks" attacked and killed just as high as the proportion of veterans that are attacked and killed. In fact, just as often as not the swarming broods will pass up old scraggy veterans to attack "blackjacks" and poles. In numerous instances the insects will be found working year after year in patches of pole timber, killing out a few trees each year, and making no effort to leave the pole patch to attack decadent trees within a limited distance, until the stand of poles has been almost entirely eliminated.

Marking in our stands of western yellow pine is governed first by the necessity of leaving sufficient trees for seed and secondly the leaving of as many thrifty trees as possible to form the nucleus of a second cut. As has been previously pointed out the beetles of *Dendroctonus* species are apt to pick out the most thrifty individuals and it is easily conceivable that the killing of a small part of the reserved stand may remove the possibility of natural reseeding over small areas within the stand, either lengthening the period of regeneration, or reducing the degree of stocking for the whole unit. The first, of course, lengthens the rotation, and the second reduces the real growing stock and the final return. I do not wish to convey the impression that to the losses of seed trees through insect attack is due the lack of reproduction in western yellow pine, but it must be perfectly clear that the subsequent loss of trees which were left for seed purposes has a direct adverse bearing on possible reproduction. In view of the difficulty of securing reproduction in stands of this species, no reasonable effort should be spared to give the cut-over areas as favorable an opportunity for restocking as possible.

The effect of varying and unexpected losses in the growing stock needs but little discussion. Under any system of management, certain departures from the working plan will be necessary on account of unforeseen contingencies, but in the degree to which these can be eliminated, by that much is the administration of the plan simplified. The death (and under a system of management we may assume the cutting) of trees which become infested cannot be considered as an intermediate return but as subtraction from the final return, and results in a decrease of the real growing stock and the mean annual increment. Further, the appearance of an epidemic infestation may require an entirely new allocation of the cutting series or area, and defeat the objects of management through the cutting of the timber into products which the plan of management does not contemplate.

We should, therefore, make every possible effort to eliminate as fully as possible all infestation from our present stands, especially when these are cut over, since the presence of insect infestation in the new growth not only will represent a serious economic loss and expense for protection, but will also present an unwarranted interference with the plans for a sustained yield.

THE FORESTRY OF THE PROPHETS

BY ALDO LEOPOLD

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Who discovered forestry? The heretofore accepted claims of the European nations have of late been hotly disputed by the Piutes. I now beg leave to present a prior claim for the children of Israel. I can hardly state that they practiced forestry, but I believe it can be shown that they knew a lot about forests. (Also, if any of them set fires, they knew better than to admit it.) The following notes, gleaned from a purely amateur study of the Books of the Prophets of the Old Testament,¹ may be of interest to other foresters, and may possibly suggest profitable fields of research for competent Hebraists and physiographers.

The most interesting side of forestry was then, as it is now, the human side. There is wide difference in the woodcraft of the individual prophets—the familiarity with which they speak of forests, and especially the frequency with which they use similes based on forest phenomena. It appears that in Judaea, as in Montana, there were woodsmen and dudes.

Isaiah was the Roosevelt of the Holy Land. He knew a whole lot about everything, including forests, and told what he knew in no uncertain terms. He constantly uses the forest to illustrate his teachings, and in doing so calls the trees by their first names. Contrast with him the sophisticated Solomon, who spoke much wisdom, but whose lore was city lore—the nearest he comes to the forest is the fig tree and the cedar of Lebanon, and I think he saw more of the cedars in the ceiling of his palace than he did in the hills. Joel knew more about forests than even Isaiah—he is the preacher of conservation of watersheds, and in a sense the real inventor of “prevent forest fires.” David speaks constantly and familiarly about forests and his forest similes are especially accurate and beautiful. Ezekiel was not only a woodsman and an artist, but he knew a good deal about the lumber business, domestic and foreign. Jeremiah had a smattering of woods lore, and

¹Quotations are from Moulton's Reader's Bible, which is based on the Revised English Version.

so did Hosea, but neither shows much leading toward the subject. Daniel shows no interest in forests. Neither does Jesus the son of Sirach, who was a keen business man, a philosopher, and a master of epigram, but his tastes did not run to the hills. Strange to say the writer of the Book of Job, the John Muir of Judah, author of the immortal eulogy of the horse and one of the most magnificent essays on the wonders of nature so far produced by the human race, is strangely silent on forests. Probably forests were his background, not his picture, and he took for granted that his audience had a knowledge of them.

FOREST FIRES IN THE HOLY LAND

Every forester who reads the Prophets carefully will, I think, be surprised to see how much they knew about fires. The forest fire appealed strongly to their imagination and is used as the basis for many a simile of striking literary beauty. They understood not only the immediate destructive effects of fires, but possibly also the more far reaching effects on watersheds. Strangely enough, nothing is said about causes of fires or whether any efforts were ever made toward fire suppression.

The book of Joel opens with an allegory in which the judgment of God takes the form of a fire.² This is perhaps the most convincing description of fire in the whole Bible. "Alas for the day!" says Joel. "The herds of cattle are perplexed, because they have no pasture; Yea, the flocks of sheep are made desolate. O Lord, to thee do I cry, for a fire hath devoured the pastures of the wilderness, and a flame hath burned all the trees of the field. Yea, the beasts of the field pant unto thee, for the water brooks are dried up. Blow ye the trumpet in Zion, and sound an alarm in my holy mountain; let all the inhabitants in the land tremble! For . . . a fire devoureth before them; and behind them a flame burneth: the land is as a garden of Eden before them, and behind them a desolate wilderness!"

Joel's story of the flames is to my mind one of the most graphic descriptions of fire ever written. It is "a day of clouds and thick darkness," and the fire is "like the dawn spread upon the mountains." The flames are "as a great people, set in battle array," and "the appearance of them is as horses, and as horsemen, so do they run. Like the

² Parts of Joel 1 and 2 have been used in printed matter issued by the Southwestern District as fire prevention propaganda.

noise of chariots on the tops of the mountains do they leap, . . . they run like mighty men; they climb the wall like men of war; and they march every one on his way. They break not their ranks: neither doth one thrust another; they march every one in his path. . . . They leap upon the city; they run upon the wall; they climb up into the houses; they enter in at the windows like a thief. The earth quaketh before them: the heavens tremble: the sun and the moon are darkened, and the stars withdraw their shining."

Joel is evidently describing a top fire or brush fire of considerable intensity. Is there at the present time any forest cover in Palestine of sufficient density to support such a fire? I do not know, but I doubt it. If not, it is interesting to speculate whether the reduced forest cover is a cause or an effect of the apparent change in climate.³ Isaiah (64-1) adds some intensely interesting evidence as to the density of forest cover in Biblical times when he says: "when fire kindleth the brushwood, . . . the fire causeth the waters to boil." Have there been any fires in this country, even in the Northwest or the Lake States which caused the waters to boil? One writer, who had to take refuge in a creek during one of the big fires in the Northwest in 1918, states that falling brands caused the temperature of the creek to rise "several degrees," which sounds very tame in comparison with Isaiah's statement. In fact, Isaiah's statement seems almost incredible. Was he telling fish stories? Or is there some special explanation, such as a resinous brushwood producing great heat, or drainage from a sudden rain on a hot fire, or a water hole containing bitumen or oil from a mineral seep? I will leave this question for some one personally familiar with the country.

That top fires actually occurred in the Holy Land is abundantly proven by many writers in addition to Joel. Isaiah says (10-19) that a fire "shall consume the glory of his forest, and of his fruitful field . . . and the remnant of the trees of his forest shall be few, that a child may write them." "It kindleth in the thickets of the forest, and they roll upward in thick clouds of smoke:" The individual tree at the moment of combustion he likens most effectively to a "standard-bearer that fainteth." Those who have actually seen the "puff" of the dying tree, as the fire rushes up through the foliage, will not miss the force of this simile. Ezekiel says (20-46): "A fire . . . shall de-

³ Prof. Ellsworth Huntington's book, "The Pulse of Asia," contains some very readable and convincing material on climatic cycles in Asia Minor.

vour every green tree . . . and every dry tree: the flaming flame shall not be quenched."

Surprisingly little is said about how fires started. Man-caused fires were no doubt frequent, as were to be expected in a pastoral community. Tobacco fires were of course still unknown. (Samuel Butler says the Lord postponed the discovery of tobacco, being afraid that St. Paul would forbid smoking. This, says Butler, was a little hard on Paul.) Lightning was no doubt the principal natural cause of fire. Very heavy lightning seems to have occurred in the mountains. David, in the "Song of the Thunderstorm" (Psalm, 29), says: "The God of glory thundereth, . . . the voice of the Lord breaketh the cedars; Yea, the Lord breaketh in pieces the cedars of Lebanon." His voice "cleaveth the flames of fire . . . and strippeth the forest bare." It is not entirely clear whether this refers to lightning only, or possibly also to subsequent fire.

How much did the prophets really know about the effects of fires? Joel has already been quoted as to the effects on streamflow, but there is a possibility that he meant that his "water-brooks" dried up, not as the ultimate effect of fires, but as the immediate effect of a drouth prevailing at the time of the particular fire which he describes. David (Psalm, 107) plainly states that changes in climate occur, but no forest influences or other causes are mentioned. I think it is quite possible that the effect of forests on streamflow was known empirically to a few advanced thinkers like Joel, but it is quite certain that their knowledge went no further or deeper. The habit of thinking of natural phenomena as acts of God instead of as cause and effect prevails to this day with a majority of people, and no doubt prevailed at that time in the minds of all. But even if the prophets were ignorant of science, they were wise in the ways of men. "Seemeth it a small thing unto you to have fed upon the good pasture, but ye must tread down with your feet the residue of your pasture? And to have drunk of the clear waters, but ye must foul the residue with your feet?" (Ezekiel, 24-18.) Here is the doctrine of conservation, from its subjective side, as aptly put as by any forester of this generation.

FOREST UTILIZATION IN THE HOLY LAND

The old Hebrew used both saws and axes in cutting timber. Isaiah (10-15) says: "Shall the axe boast itself against him that heweth therewith? Shall the saw magnify itself against him that shaketh it?"

"Shaking" the saw is a new bit of woods vernacular that leads one to wonder what the instrument looked like. Here is more woods vernacular: ". . . he shall cut down the thickets of the forest with iron, and Lebanon shall fall by a mighty one." While I am not competent to go behind the translation, the word "iron" seems to be used here in much the same way as our modern engineers used the word "steel," that is, to indicate certain manufactured tools or articles made of steel.

Very close utilization of felled timber seems to have been practiced. Solomon (Wisdom, 13-11) tells how a woodcutter sawed down a tree, stripped off the bark, carved the good wood into useful vessels, cooked his dinner with the chips, and used the crooked and knotty remainder to fashion a graven image. Expertness in whittling then, as now, seems to have been a trait of the idle, for Solomon says the wood-cutter shaped the image "by the diligence of his idleness, and . . . by the skill of his indolence." Isaiah (44-14) also tells how a man plants a fir tree, and after the rain has nourished it, he cuts it down and uses a part to warm himself, a part to bake bread, a part to make utensils, and a part to fashion a graven image. Graven images, if one is to believe the prophets, must have been an important product of the wood using industries of that day.

Here is an unsolved mystery in woods practice: "The carpenter . . . heweth him down cedars, and taketh the holm tree and the oak, and *strengtheneth for himself* one among the trees of the forest" (Isaiah, 44-14). What is meant by "strengtheneth for himself?" Some process of seasoning? Some custom of individual branding such as is practiced on bee trees? Some process of lamination in wood-working to give strength and lightness?

Ezekiel (27-4) records some interesting data on the sources and uses of timber in his satire on the glories of Tyre. "They have made all thy planks of fir trees from Senir: they have taken cedars from Lebanon to make a mast for thee. Of the oaks of Bashan have they made thine oars; they have made thy benches of ivory inlaid in boxwood, from the isles of Kittim." Isaiah (2-18) also mentions "the oaks of Bashan." Oak would seem to be a bit heavy for the long oars used in those days.

Who made the first cedar chest? Ezekiel (27-24) says that "chests of rich apparel, bound with cords and made of cedar" were an article of commerce in the maritime trade of Tyre. The use of cedar chests for fine clothing seems to be nearly as old as the hills. Solomon's pal-

anquin was also made of cedar. Here is his own description of it, as taken from the Song of Songs (3-9): "King Solomon made himself a palanquin of the wood of Lebanon. He made the pillars thereof of silver, the bottom thereof of gold, the seat of it of purple, the midst thereof being inlaid with love from the daughters of Jerusalem." (I doubt whether Solomon "made himself" this palanquin. He does not give the impression of a man handy with tools. No doubt he had it made by the most cunning artificers of his kingdom.)

Cedar construction in Biblical days seems to have been a kind of mark of social distinction, as mahogany is today. (Witness also the marble-topped walnut of our Victorian forbears!) Solomon's bride boasts (Song of Songs, 1-16): "Our couch is green. The beams of our house are cedars, and our rafters are firs." Jeremiah (22-14) accuses Jehoiakim of building with ill-gotten gains "a wide house . . . with windows . . . ceiled with cedar, and painted with vermilion." "Shalt thou reign," exclaims Jeremiah, "because thou strivest to *excel in cedar?*"

The cedar seems to have grown to large size. Ezekiel, in a parable (31), says of one tree: "The cedars in the garden of God could not hide him; the fir trees were not like his boughs, and the plane trees were not as his branches." This cedar was Pharaoh, and the Lord "made the nations to shake at the sound of his fall."

The close utilization which seems to have been practiced at least in some localities, the apparently well developed timber trade of the coast cities, and the great number of references to the use and commerce in cedar, would lead to the surmise that the pinch of local timber famine might have been felt in the cedar woods. That this was actually the case is indicated by Isaiah (14-7). After prophesying the fall of Babylon, he tells how all things will rejoice over her demise. "Yea, the fir trees rejoice at thee, and the cedars of Lebanon: 'Since thou art laid down, no feller is come up against us.'" This impersonization of trees is characteristic of the Biblical writers; David (Psalms, 96) says, "Then shall all the trees of the wood sing for joy."

The relative durability of woods was of course fairly well known. Isaiah (9-10) says: "The bricks are fallen, but we will build with hewn stone; the sycamores are cut down, but we will change them into cedars." Ecclesiasticus (12-13) likens the permanency and strength of wisdom to "a cedar in Libanus, and . . . a cypress tree on the mountains of Hermon."

Fuel wood was evidently obtained not only from cull material, as already indicated, but by cutting green timber. Ezekiel (39-9) predicts that after the rout of the invading army of Gog, "they that dwell in the cities of Israel shall go forth, and make fires of the weapons and burn them, . . . and they shall make fires of them seven years; so that they shall take no wood out of the field, neither cut down any out of the forests." It would seem that Biblical fuel bills were either pretty light, or else Gog left behind an extraordinary number of weapons.

HEBREW SILVICULTURE

There are many passages in the books of the Prophets showing that some of the rudimentary principles of silviculture were understood, and that artificial planting was practiced to some extent. Solomon (in Ecclesiastes 2-4) says that he planted great vineyards, orchards, gardens, and parks, and also "made me pools of water, to water therefrom the forest where trees were reared." Isaiah (44-14) speaks of a carpenter who planted a fir tree, and later used it for fuel and lumber. The context gives the impression that such instances of planting for wood production were common, but probably on a very small scale. Isaiah (41-9) seems to have had some knowledge of forest types and the ecological relations of species. He quotes Jehovah in this manner: "I will plant in the wilderness the cedar, the acacia tree, and the myrtle, and the oil tree; I will set in the desert the fir tree, the pine, and the box tree together." He also makes the following interesting statement (55-13) which possibly refers to the succession of forest types: "Instead of the thorn shall come up the fir tree, and instead of the brier shall come up the myrtle tree."

Some of the peculiarities of various species in their manner of reproduction are mentioned. Isaiah (44-4) says: "They shall spring up among the grass as willows by the watercourses." He also speaks of the oak and the terebinth reproducing by coppice (6-12). Job (14-7) also mentions coppice, but does not give the species. Ezekiel (17) in his parable of the Eagles and the Cedar, tells about an eagle that cropped off the leader of a big cedar and planted it high on another mountain, and it brought forth boughs, and bore fruit, and was a goodly tree. I do not know the cedar of Lebanon but it sounds highly improbable that any conifer should grow from cuttings. I think this is a case of "poetic license."

Isaiah (65-22) realized the longevity of some species in the following simile: "They shall not build, and another inhabit; they shall not plant, and another eat; for as the day of a tree shall be the day of my people, and my chosen shall long enjoy the work of their hands." Isaiah disappoints us here in not telling the species. Unlike Solomon and Daniel and Ecclesiasticus, he is not given to calling a tree just "a tree."

MISCELLANEOUS

Barnes has written a very interesting article ⁴ on grazing in the Holy Land, and there is much additional material on this subject which would be of interest to foresters. One matter which some entomologist should look up occurs in Isaiah (7-18). Isaiah says: "And it shall come to pass in that day, that the Lord shall hiss for the fly that is in the uttermost part of the rivers of Egypt, and for the bee that is in the land of Assyria. And they shall come, and shall rest all of them in the desolate valleys, and in the holes of the rocks, and upon all thorns, and upon all pastures." What fly is referred to? The Tsetse fly, or the Rinderpest?

There is also considerable material on game and fish in the Old Testament, and additional material on forests in the historical books, both of which I hope to cover in future articles.

In closing, it may not be improper to add a word on the intensely interesting reading on a multitude of subjects to be found in the Old Testament. As Stevenson said about one of Hazlitt's essays, "It is so good that there should be a tax levied on all who have not read it."

⁴ National Wool Grower, February, 1915.

REVIEWS

Tenth Annual Report, Commission of Conservation of Canada.
Ottawa, 1919, pp. 278.

The Commission of Conservation of Canada is a purely investigative and advisory body, having no executive or administrative functions whatever. It is interesting to note that this commission was an outcome of the great conservation movement, headed by President Roosevelt, which brought about the conference of Governors at Washington in 1908 and was followed by the North American conference shortly after. It was the report of the Canadian delegates to this international conference that determined the Government of Canada to establish a Commission of Conservation. This commission has persisted, though the National Conservation Commission of the United States fell by the wayside.

The tenth annual report of the commission comprises the proceedings of the annual meeting held at Ottawa, February 17, 1919, and embraces, for the most part, a review of developments along conservation lines during 1918, with recommendations. The discussions cover such subjects as water-power, housing, town-planning, public health, agriculture, fuel supplies, and forestry.

The report is unusually rich in forestry material, containing reports by Clyde Leavitt, Chief Forester of the Commission; Dr. C. D. Howe, in charge of forest research, and R. D. Craig, in charge of the investigation of forest resources on the commission's forestry staff.

The report of the Committee on Forests, by Mr. Leavitt, embraces a review of the forestry situation during the previous year, with recommendations for future action. The situation for each province is reviewed separately, as also with respect to the Dominion Government. Very material progress has taken place, notwithstanding war conditions, but only a beginning has yet been made toward the actual practice of forestry. The ownership by the Dominion and provincial governments of the great bulk of the non-agricultural timberland throughout Canada renders the situation very much more favorable for future forestry practice than is the case in the United States, taken as a whole.

Dr. Howe presents a preliminary report on the Quebec forest regen-

eration survey, which is being carried on in that province under a plan of co-operation between the Commission of Conservation and the Laurentide and Riordon Pulp and Paper Companies. In addition to studies of regeneration, volume and growth of pulpwood species, permanent sample plots have been established upon which detailed observations will be taken periodically throughout a long period of time. Collaboration is also established with the Dominion Entomological Branch, under which Dr. J. M. Swaine is making investigations of forest insects, with special reference to the balsam (or spruce) budworm, which has caused enormous damage in the pulpwood forests of eastern Canada, the damage to the balsam being much greater than to the spruce.

Dr. Howe contributes also a second paper entitled "How Shall We Make Our Forests Safe for Trees?" In this are discussed losses from fire, insects, and disease, and the effect of present methods of conducting logging operations, in the gradual or rapid conversion of the mixed softwood-hardwood forests into hardwood forests.

Mr. Craig's contribution to the report comprises a review of air plane lumber production in British Columbia. During the latter portion of the war Mr. Craig's services were loaned by the Commission of Conservation to the Imperial Ministry of Munitions in order that he might take charge of the inspection of air plane lumber purchased in British Columbia for the British Government, through the Imperial Munitions Board. Major Austin C. Taylor was appointed Director of the Department of Aeronautical Supplies by the board, his assistant being H. R. MacMillan, formerly Chief Forester of the British Columbia Forest Branch, but who, more recently, has gone into the export timber business, with headquarters at Vancouver. Mr. Craig's report summarizes the important contribution made by the forests of British Columbia toward the winning of the war, through the furnishing of large quantities of Sitka spruce and Douglas fir for air plane manufacture.

C. L.

Effect of Kiln Drying on the Strength of Airplane Woods. By T. R. C. Wilson, Forest Products Laboratory. Report No. 68 of the Fifth Annual Report of the National Advisory Committee for Aeronautics, 1920.

In this report are given the summaries and conclusions obtained from over 100,000 mechanical tests, covering approximately 100 kiln

runs and 26 species of wood. These tests were undertaken in co-operation with the War and Navy Departments for the purpose of determining whether Signal Corps Specification 20500A, "General Kiln Drying Process for Airplane Stock," as already prepared by the Forest Products Laboratory from its extensive studies in kiln-drying, was entirely safe for drying material in which the maximum strength must be reserved. It was also desirable to find out whether more rapid processes than those allowed by Specification 20500A might possibly be developed.

Two methods of procedure were followed: One was to compare the strength of kiln-dried material with results previously obtained from tests on green and air-dry material of the same species, but obviously of different trees. On the basis of this comparison tentative conclusions were drawn as to whether kiln drying had produced as favorable a change in properties as had been found, from previous tests, to result from air drying. This method gave quick results but the conclusions drawn could not be so accurate or dependable as was desirable because the test pieces in the two series of tests were from different trees, and not directly comparable.

The other procedure was to select and test green, air-dry, and kiln-dry matched pieces from the same tree and even from the same portion of the tree. This took considerably longer because of the time necessary to allow for thorough air seasoning. But the results were more satisfactory of the species dealt with in the report. Sitka spruce, Douglas fir, white pine, and white ash were tested in this way, while tests on kiln-dried material of the other 22 species are compared, in the publication, only with tests on material from previous shipments, since the results of tests of matched kiln-dried and air-dried material were not available when the publication was prepared.

In comparing test data on kiln-dried material with previously tested air-dried material it was found that more reliable conclusions could be drawn by comparing the amounts of change in properties which took place in drying the material from the green condition, instead of by comparing the strength values themselves directly. The change in the properties due to drying was termed the "improvement ratio." It is expressed by the formula

$$\text{Improvement ratio} = \frac{\text{Strength value for kiln or air dried material}}{\text{Same strength value for matched green material}}$$

This is consistently greater than 1 for all properties except work to maximum load in static bending, height of drop of hammer in impact bending, and modulus of elasticity, for which it occasionally is slightly less than 1.

Because the strength of air-dry and kiln-dry wood varies with the moisture content it was, of course, necessary to adjust the strength values of the seasoned wood to a uniform moisture content in order to make a satisfactory comparison. This was done by means of a formula derived from the many strength tests previously made, including data in Forest Service Circular 108 and Forest Service Bulletin 70.

The following general conclusions are reached:

(1) That wood may have its strength properties, particularly toughness or resistance to shock, quite seriously damaged without any visible evidence of such damage. Hence, *appearance* of the material can not, where maximum strength is essential, be accepted as the sole basis of judgment of the effect of a drying process of wood.

(2) That the effect of a given process is not the same on all species of wood.

(3) That apparently a given process may be entirely safe for some but quite detrimental to other material of a species.

(4) That proper kiln drying produces material fully equal in all strength properties to that resulting from air drying under the most favorable conditions.

(5) That specification 20500A of the Bureau of Aircraft Production (Table 1 or 2 as specified) can in most cases be expected to produce material fully equal to air-dried.

(6) That best results (with respect to strength properties) on Douglas fir will result from the use of somewhat milder drying conditions than those laid down in Specification 20500-A (Table 1). Table 2 of this specification (temperatures 105° F. initial to 135° F. final and relative humidities 85 per cent initial to 40 per cent final) is recommended for drying Douglas fir.

(7) That in some species there is apparently no relation between drying temperatures up to 180° F. and the strength properties of the dry material. Such a conclusion, however, needs further confirmation, and temperature higher than those of Specification 20500-A have not been recommended.

A. K.

Glues Used in Airplane Parts. By S. W. Allen and T. R. Truax, Forest Products Laboratory. Report No. 66. Preprint from Fifth Annual Report, National Advisory Committee for Aeronautics. Pp. 28.

This report is a compilation of results on glues and gluing obtained by the Forest Products Laboratory in its war-time study of this subject. Various types of glue, including animal, liquid, vegetable, casein, and blood albumin glues are discussed in some detail but most emphasis is placed upon the casein and blood glues, for which formulas worked out at the Laboratory are given. A table is given comparing the sources, costs, properties, and uses of the different types of wood-working glue, and methods of testing are described.

The discussion of glues is of interest to foresters in view of the value of glue as a means of conserving wood, and the possible influence which the development of a highly waterproof glue may have upon forest crop rotation and selection.

G. M. H.

Handbook of Nebraska Trees. By Raymond J. Pool, Professor of Botany, The University of Nebraska, Bulletin 7, The Nebraska Conservation and Soil Survey, March, 1919.

Although less than three per cent of the area of Nebraska is covered by natural timber, great interest is attached to the forest trees of this state. Where timber is scarce its local value is greatly enhanced and popular interest in arborescent vegetation is proportionately greater. The "Handbook of Nebraska Trees," therefore, will be enthusiastically received by the citizens of the state, who are fortunate in having the subject presented to them by so competent an authority as Doctor Pool.

The plan of the bulletin, the illustrations and maps are excellent and the identification keys and botanical descriptions non-technical and effective. The unscientific lover of trees and the professional dendrologist will equally appreciate this valuable publication. Teachers of nature-study and school pupils who may not wish to follow the accurate methods of science in making their identifications can readily search for a picture of the specimen in hand, while the trained botanist will find ample material for study. Forest geographers will be especially interested because of the fact that the natural ranges of an unusually large number of important forest trees terminate in Nebraska. Exclusive of about a dozen shrubby species which attain tree size

largely outside of this state, there are about 60 tree species native to Nebraska. These are mostly pioneers from the eastern forest that for reasons unknown have alone been able to push into the treeless region, surviving the great prairie fires that swept unchecked across Nebraska before the days of cultivated fields.

The distribution maps are accurate and the discussion of the ranges under each species constitute a valuable contribution to forest geography. A dotted line appears across the base maps which although not so designated, is evidently the 100th meridian. Western trees cross this line eastward and eastern species extend further westward, but the reviewer has accepted this meridian as the most logical dividing line between the eastern and western forests in a recent contribution on the distribution of western conifers. (*American Lumberman*, Chicago, April 3, 1920.)

Doctor Pool's handbook evidences in the most pleasing manner the present trend in botanical literature. It is an unfortunate fact that popular interest in a natural science remains lethargic until the experts exhaust its taxonomic and nomenclatorial aspects. No better exemplification of this truth can be found than by a comparison of the progress toward popular literature in the fields of entomology, dendrology and ornithology. Our native birds are about all known. The experts no longer disagree and popular manuals of bird study are being sold by the hundreds of thousands. Dendrology should have reached this happy estate first because we have only about half as many species of native trees as of native birds, and illustration of the distinguishing characteristics of trees does not require expensive color printing. Entomology naturally follows behind on account of the enormous number of species of insects involved and the large number of new species annually discovered.

Dendrologists, therefore, are fortunately situated to adequately supply the popular demand for tree books. Their genera and species are more or less stabilized with the exception of a few special groups like the hawthorns which are even more confusing to the botanist than are the wood-warblers to the ornithologists. With such manuals as this excellent handbook, the so-called laity need no longer exclaim with Thomas A. Kempis: "What have we to do with genus and species?"

With a guide like this, the uninformed may have a great deal to do with genera and species of trees in the region covered. Dendrologically he may get wisdom, and if with that wisdom he can also get understanding, he may approach closer than ever before to the mys-

teries of nature as revealed in the phenomena of plant life. It is impossible, however, to know plants as living things or to comprehend the great truths about them unless we know what sort of plant it is that has excited our wonderment. Just as we love our fellow creatures as individuals with names, so we must be able to identify the tree before we can enter into any closer relationship.

The Genera of Grasses in the United States, with Special Reference to Economic Species. By A. S. Hitchcock, Systematic Agrostologist. U. S. Department of Agriculture, Bul. 772. Contribution from the Bureau of Plant Industry. 1920. Pp. 307.

All genera of grasses are described that embrace native, introduced, or cultivated species in the United States. Under each genus reference is made to the type species and to species of economic importance, both useful and harmful plants. The economic consideration takes into account the grasses that are used for hay or pasture purposes, for cereal and sugar production, those used in broom and paper making, and the ornamental species. Throughout the paper the word "grass" is used strictly in its botanical sense; that is, as applying only to the plants of the family *Poaceae* or *Gramineae*.

The keys to the tribes and genera are arranged in a simple, workable way, and these, together with an illuminating half natural size photograph or sketch of a representative species under each genus, should enable the amateur botanist readily to fix in his mind the generic characteristics, and, indeed, the species typifying the genus. A brief of the publication of each generic name is given and the reason is stated for choosing the species taken as a type.

The arrangement of the material, in general, differs from that of previous contributions on the subject in that the tribes have been placed in a new sequence based upon the complicity of the flower structure, the simplest or most primitive being placed first and the most highly developed being given last. According to the author's researches, the tribal arrangement as presented is the closest approximation to the natural relationship that can be shown in sequence. Accordingly, the bamboos (*Bamboseae*) are listed first, as certain genera embraced in this tribe are of the simplest floral structure.

The following points are of special interest to agrostologists:

Munroa has been placed under the tribe *Chlorideae*.

Triodia has been restored; and while the species embraced in this genus are variable in habit and in floral character, the author does not deem it practicable to segregate any of them into distinct genera.

Aira has been restored and *Deschampsia* relegated to synonymy under it.

Aspris is used for three annual economically unimportant species heretofore carried under *Aira*.

Agrostis palustris is the name given for *A. alba*—cultivated reedtop. *Agrostis capillaris* replaces what has been considered a variety of cultivated reedtop—*A. alba vulgaris*.

The synonymy is complete for generic names based on American species.

The lifelike sketches of representative species by Mrs. Gill and the detailed taxonomic drawings by Assistant Agrostologist, Mrs. Agnes Chase, practically all of which are new, are exceedingly helpful in the recognition of the species typifying each genus.

ARTHUR W. SAMPSON.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION

The Forests of Siberia

The rest of the world knows little about Siberia, what is really going on there now, and what the final outcome will be as it knows about any other country on this globe. However, a graduate Russian forester, Alexander Koroleff, who has spent most of his life in Siberia, and who is now in the United States, tells something about the forests of that unknown country in a recent issue of *The Timberman*. According to Mr. Koroleff, there are some 1,080,000,000 acres of forest land in Siberia proper. Of this immense area about 4 per cent belongs to the Cossacks and the peasants and 96 per cent to the Government (?). The Government forests are of two classes, "free-use" forests and those under the bureau of forestry; the latter has under its jurisdiction about 44 per cent of the total timbered area of Siberia, or about 440 million acres. About 25 per cent of the commercial forest has been examined and roughly surveyed. The valuable species are pine, larch, kedr (?), fir, and spruce. Pine, larch, and kedr form about 44 per cent and spruce and fir about 22 per cent of the commercial forests. In eastern Siberia are excellent hardwoods, such as oak, ash, and walnut. The annual timber production from the Siberian Government forests normally is about 240 million cubic feet. Before the war the annual timber exports amounted to only five million cubic feet. Mr. Koroleff was sent to the United States last year by the Kolchak Government to study American logging and sawmilling methods; now there is no Kolchak Government, but he is continuing his study. With the return to Siberia of peace and a settled condition of the country there should be an enormous opportunity for American foresters in Siberia, as well as for manufacturers of American logging and sawmill machinery.

J. D. G.

Siberia Wants American Logging and Sawmill Machinery. Alexander Koroleff. *The Timberman*. February, 1920.

SOIL, WATER, AND CLIMATE

Soil Aeration in India

In summarizing the recent work done on soil aeration in India, Albert Howard and R. S. Hole point out that only very indirectly has soil aeration been recognized in European agricultural literature and that being in connection with the importance attached to a proper soil texture. The authors maintain that soil texture is really important because of its influence on soil

aeration. The intervening spaces between the soil particles is occupied by water and air, the water being found in thin films around the soil particles while the air fills the remainder of the pore space. Since the air is being called on to provide a constant supply of oxygen for respiration and in turn receives fresh supplies of carbon dioxide, efficient ventilation is very essential if the air in the pore spaces is to remain fresh. There must be a diffusion of gases between the soil and the atmosphere above; supplies of oxygen must pass into the soil and at the same time the excess carbon dioxide passes to the atmosphere. Three gases are involved—oxygen, carbon dioxide, and nitrogen. In general the oxygen and carbon dioxide contents are reciprocal—the amount of oxygen in the soil decreasing as the amount of carbon dioxide increases and vice versa. The water films were found generally to be very poor in oxygen but very rich in carbon dioxide. Rain, which was found in most cases to be a saturated solution of oxygen, resulted in a marked stimulation of the biological activities of the soil.

Because of the difficulty encountered in establishing a vigorous growth of Sal (*Shorea robusta*) seedlings, a study of the factors influencing germination and development of seedlings was undertaken at the Forest Research Institute at Dehra Dun in 1909. Pot experiments showed that while it was practically impossible to injure Sal seed and seedlings by watering in sand, germination could be materially reduced and the seedlings rapidly rendered unhealthy in water-retaining loam and leaf-mould by keeping the soil constantly moist. Similar results were subsequently obtained with loam taken from a local Sal forest. The injurious action was most severe in the leaf mould which contained considerably more organic matter than the loam.

Simultaneously with these pot experiments, a series of experiments was conducted in the Dehra Dun Sal forests. These showed that, while in the shade of the forest germination and seedling development during the rainy season was uniformly poor, even when the soil covering of dead leaves is removed and the soil dug up, excellent seedling growth can be obtained if the trees are felled in narrow strips or small patches and the seed then sown in the clearings where the soil is exposed to the sun and air. It was clearly demonstrated that the injurious agent was a soil factor and not deficient light by growing healthy seedlings with well-developed roots in pots containing sand placed in the shade of the forest. Many of the seedlings appeared quite healthy with green leaves above ground while a number of the deeper roots were

dead and rotten. This also showed that the injurious agent was a soil factor and the symptoms convey the impression of a localized poisonous action rather than of a general starvation effect due to lack of essential food materials.

The effect of various quantities of CO_2 gas on Sal roots was tested by growing the seedlings in water cultures and bubbling the gas through the culture solutions. It was found that when the concentration of the gas reached approximately 500 milligrams per liter, the delicate root tips and rootlets of vigorous Sal seedlings are blackened and killed and the production of new roots was inhibited, the appearance of the damaged roots resembling that of those found in poorly aerated soil. The authors suggest determining the amount of oxygen and CO_2 in the soil as the most reliable indication of the conditions of aeration in the soil and they define a badly aerated soil as one in which there is a deficiency of oxygen and an excess of CO_2 .

The authors show the paramount importance of soil aeration in the silviculture of the Sal and contend that the various agencies which influence soil aeration can be controlled to a considerable extent by ordinary forest practices. The quantity of water, of soil organisms, and of organic matter can be regulated by varying the shade and quantity of dead leaves added to the soil and also by the controlled use of fire. Texture is also influenced by the amount of organic matter in the soil and also by such factors as the grazing of live stock, both of which are capable of regulation. In some cases the temporary encouragement of the growth of certain grasses and other herbs, the roots of which are much sought after by rodents and hogs, is advocated for improving soil texture. The felling of trees and the subsequent decay of the subterranean roots is also an important factor in influencing soil aeration.

American silviculture can well afford to recognize the fundamental importance of soil aeration in the treatment of the heavy calcareous forest soils found in certain sections of this country.

C. F. K.

Howard, Albert, and Hole, R. S. *Recent Investigations on Soil Aeration*. Indian Forester, 44:187-212, May, 1918.

*Sunlight
and Its
Measurement*

Of late there has been considerable discussion among foresters of the term tolerance and the adequacy of the definition as generally accepted has been seriously questioned. The light requirements of a species and tolerance can no longer be accepted as synonymous. We now know that the vigor and growth of a tree growing under an overwood is determined not only by competition for light but by competition for soil nutrients and soil moisture.

There is serious need for a reinvestigation of tolerance and a more precise definition of its relation to light requirements. As a part of the basis for such work and an understanding of the effect of sunlight on forest vegetation and the difficulties encountered in measuring its effect the article by Professor Pulling on sunlight and its measurement is of interest.

Sunlight applies strictly only to that portion of the sun's radiation that is capable of producing sensations of light in man. We cannot say that only this portion affects forest vegetation. We know, however, that its effect is greater than any other portion of the sun's radiation.

The first part of the author's paper is a brief, non-technical statement of our present knowledge concerning the distribution and the amount of energy in the incoming radiation from the sun. The second part outlines the complex subject dealing with the measurement of the sun's radiation. A short bibliography is added to indicate the locations of some of the more thorough discussions of the important points. Part one is illustrated by many graphs and special emphasis is placed upon the distribution of energy in the sun's spectrum and the distinction between prismatic and normal spectra.

Little is said or can be said concerning the total effect of the atmosphere upon radiation at any given time. In general, however, losses from incoming solar energy occur in seven ways: (1) General scattering by the permanent gases of the atmosphere; (2) general scattering by water vapor; (3) selective (banded) absorption by the permanent gases; (4) selective (banded) absorption by water vapor; (5) absorption and reflection by clouds; (6) absorption and reflection by dust; (7) absorption in chemical reactions.

Each of the above conditions increases with the amount of the effective substance between the object receiving the radiations and the sun, also with the total distance traversed by the light beam through the atmosphere with any given concentration of effective material.

Part two, which deals entirely with the measurement of solar radiation, emphasizes the fact that as it is a variable both in quantity and quality at any given station its influence on vegetation can only be determined by artificial illuminants or else the incoming radiant energy must be constantly measured. A brief note is made of the use of artificial illuminants.

Each of the three general methods for measuring radiation (radiometry, photometry, and actinometry) is briefly discussed as well as

the several lines under which each has been developed. Although the author goes into considerable detail in describing each of the above methods he draws no conclusions as to which method is the best in measuring the sun's radiation with particular objects in view. For instance he gives no clue as to the best method for measuring solar radiation in order to ascertain its effect upon living vegetation.

J. W. T.

Pulling, Howard E. *Sunlight and Its Measurement*. The Plant World, Vol. XX, Nos. 7 and 8, pp. 151-171 and 187-209.

SILVICULTURE, PROTECTION, AND EXTENSION

Applied Entomology in America

The biological method of combating insect pests (by favoring the development of their natural enemies) was first suggested to the author in connection with ravages of the gypsy (*Lymantria dispar* L.) and the brown-tail moths (*Euproctis chrysorrhoea* L.) and the oak caterpillar (*Cnethocampa processiona*, L.) on the south slopes of the Transylvanian Alps in Roumania in 1887, and in Croato-Slavonia and Bosnia in 1889. This method has been developed on an extensive scale in the United States, under the leadership of the Bureau of Entomology (a number of instances are given) and other methods have also been widely studied, especially the use of chemicals. The success of American entomologists in this work, which requires a very thorough detailed knowledge of the insects, their life habits, and their enemies, is attributed to their capacity for going deeply and thoroughly into a study and to their adaptation to observational investigation of practical value, but primarily to the organization of entomological research activity, with its division of work among specialists, and its centralization or correlation by a central agency at Washington. Prof. Escherich has been striving for development along similar lines in Germany, through his Society for Applied Entomology and his *Zeitschrift fur Angewandte Entomologie*, and has laid the beginnings of a Research Institute in Munich, to study methods of combating insect pests injurious to farms, forests, and farm and forest products and articles made from them, as well as to domestic animals and human beings. The Institute is to be exclusively for research, not for instruction, but is to publish its results in language that can be understood by practical farmers, foresters, and manufacturers. Esche-

rich emphasized the necessity of a universal application of control measures—no use to control a pest on one area and not on the adjacent one—but prefers to accomplish this through education of the public rather than forcibly through laws. This can be done through teachers of winter short-courses, through traveling teachers, and through technically and practically trained insect-pest inspectors, who shall keep posted on the development of the science and pass their knowledge on by means of demonstrations and otherwise. There is perhaps not much hope of making the older generation receptive to such educational propaganda, but much can be done with the coming generation, particularly if elementary instruction regarding the principal beneficial and noxious insects can be given in the public schools. Dr. Seitner is pushing the development of a similar scheme in German Austria. He suggests a central office, well furnished with equipment and trained personnel, and State entomologists or traveling inspectors to collect information and statistics and carry on control work.

W. N. S.

Petraschek, Karl. *Einiges über die angewandte Entomologie in Amerika und ihren Einfluss auf die entomologischen Reformbestrebungen in Deutschland und Deutsch-Österreich.* Forstwiss. Centralbl. 41: 161-173. 1919.

MENSURATION, FINANCE, AND MANAGEMENT

	According to Walker, "the trend of opinion in
<i>Management of</i>	Burma has set strongly in favor of converting
<i>Teak in</i>	our natural teak forests into even-aged woods."
<i>Burma</i>	These reserved forests are maintained for export
	purposes, and the chief argument in favor of
	even-aged teak stands seems to be based upon the policy of a partial
	abandonment of the selection system in Europe rather than on local
	requirements in Burma—hence Walker opposes the change. His argu-
	ments are

(1) What is done in Europe is no criterion for Burma. "To abandon a system (selection) which is in many ways admirably suited to an undeveloped forest on account of a doubtful theory that under another system (shelterwood) a higher degree of regularity of the yield would thereby be insured, seems to me to be the height of absurdity."

(2) The yield would really be more irregular than with the present selection method, and the conversion would mean difficulty and disarrangement, and the revenue would be dangerously reduced.

(3) Considering that teak only forms a small per cent of the typical stand, any change of system would practically mean reforestation with an enormous expense.

(4) With properly executed working plans a regular sustained yield can be secured even with the present system of cutting.

Walker is frank in his criticism of present silvicultural, economic, and regulation methods, and suggests that *part* of the cost of the proposed conversion could better be spent in improving the stand by freeing teak from competition with weed species. What Walker fails to realize and apparently has entirely overlooked is that *the weed species will presently become merchantable as the world's timber supply dwindles*. This is the strongest argument against regularizing the stands by replacement with pure teak, which to my mind is not as yet justified by the economic conditions even if it could be done.

T. W. S., JR.

Walker, H. C. *The Management of a Teak Forest*. Indian Forester, Vol. XLV, Nov., 1919, pp. 561-578.

STATISTICS AND HISTORY

The armies of the Allies in western Europe were not, it seems, the only ones to establish a forest service as a definite part of their military organization. Up to February, 1917, the wood needed by the French Army of the Orient was secured by shipments from France and by purchase in the Salonica market. It was then decided to utilize local forest resources to a greater extent and two centers of exploitation, each under a forest officer of the grade of captain, were established, one on the Island of Thasos and the other on the Peninsula of Mt. Athos.

By the end of the year it became evident that the army could no longer depend on France for even a part of its wood supplies, and in January, 1918, an army forest service, similar to those already in existence in France, was created. This service, which reported directly to the commander of the allied armies in the Orient, was charged both with supplying to the French army the wood needed by all of its various services (except the airplane), and with apportioning the forests and wooded regions in the zone of the rear among the various allied armies. Two new centers of exploitation, connecting with Sal-

onica and the zone of the front by rail, were established in March in addition to the two which had been established in 1917 and which connected with Salonica only by rail. Technical direction was also assumed of a rudimentary forest service which had been established in 1917 in the zone of the front.

The principal species utilized were chestnut, oak, beech, poplar, ash, elm, fir, and pine. Since none of the Greek forests are under management the cuttings were conducted wherever conditions were most favorable, cultural obligations, however, always being respected. In spite of the many difficulties encountered, the forest service succeeded in meeting all of the needs of the army for wood, saved tonnage, stabilized prices, and preserved many forests from destruction.

S. T. D.

C. G. *Le service forestier de l'Armée d'Orient*. Revue des Eaux et Forêts. 56: 196-199. 1919.

For the first time the secret of the timber supply for the troops operating against Bulgaria is given to the public. Up to 1917 the supply was partly shipped from France, and was partly bought and produced locally; but beginning in December, 1917, all shipments ceased because of difficulty of transport, and in January, 1918, General Sarrail authorized an army supply service. The first centers of exploitation were in the Island of Thasos and on Mount Athos, where the chief species were pine, fir, chestnut, and oak. Later two new centers, with small portable mills, were established in Macedonia. According to C. G., the results were satisfactory, since (1) The prices charged by profiteers were kept down; (2) the army was supplied with timber; (3) tonnage was saved.

The writer concludes that the ruination of a certain number of forests which otherwise would have been destroyed by timber merchants was prevented by conservative logging. One cannot but remark that the term "forestry" is a misnomer when used to describe army exploitations.

T. S. W., JR.

C. G. *Le Service Forestier de l'Armée d'Orient*. Revue des Eaux et Forêts. 57: 196-199. 1919.

POLITICS, EDUCATION, AND LEGISLATION

*Police Force
for
Indian Forests* "Arpi" proposes a "separate forest police branch of the department with a view to relieving trained forest officers of a branch of work—the protection of forests against damage by man—which requires no special knowledge of forestry,"

on the ground that foresters at present waste three-fourths of their time on forest police matters. Apparently the force is not to be used on fire protection; if so, this is certainly an error in organization. The organization planned is as follows

(1) Controlling staff (British)—Superintendent, \$200 up to \$317 per month; assistant superintendent, \$66 up to \$191 per month.

(2) Subordinate staff (native)—Inspectors of forest police, \$17 up to \$50 per month; sub-inspectors, \$8 up to \$13 per month.

(3) Protective staff (native)—Head forest police constables, \$7 per month; forest police constables, \$4 to \$6 per month.

The superintendent would correspond to our forest supervisors, *but his duties would be limited to protection against man* on the forest area; inspectors would correspond to our rangers; the constable would be similar to a guard in charge of a beat of about 3,000 to 6,000 acres. The area under a superintendent would correspond to either a civil police district or the forest division (our National Forest); each would have its advantages. The intensity of organization is shown by the force estimated for "an *average* forest police district": 1 superintendent, 4 inspectors, 8 to 12 sub-inspectors, 75 constables, costing in all \$830 to \$1,000 per month. Perhaps such an expensive organization is partly due to the "unrest" of the subject races in British India and to the consequent spread of crime within forest areas.

T. S. W., JR.

"Arpi". *The Future Organization of the Forest Department in India*. Indian Forester. 45: 636-643. 1919.

MISCELLANEOUS

*The Scientist
and
the Press* With the increasing appreciation of the value of research in present-day affairs the attention of foresters, and especially those of the profession concerned primarily with its technical phases, is called to a timely address on the press and the scientific world. This address was delivered by a newspaper man, of long training and high accomplishment in his field, before a meeting of

the Pacific Division of the American Association for the Advancement of Science, held at Pasadena, Calif., in June, 1919. The author, Mr. Rowell, aptly says "For our most grievous lack, as a people, is our ignoring of experts, and our fiction that 'any man is fit for any job.' The one German lesson which we must not permit the war to unteach us, but which it must rather emphasize a thousand fold, is the lesson of valuing and trusting the expert." The author explains succinctly what is news, how scientific facts can be made into news, and the duty of scientists (and therefore foresters) toward the press. It is a most readable and instructive address.

J. D. G.

The Press as an Intermediary Between the Investigator and the Public. Chester H. Rowell. Symposium; Scientific Education in a Democracy. Throop College Bulletin. Vol. XXVIII, No. 84. July, 1919.

NOTES

MANY NEW JERSEY WOODLAND OWNERS ARE PRACTICING FORESTRY

A survey of the progress of forestry in New Jersey, conducted during the past winter to determine the extent that woodland owners have actively engaged in forestry practice, has shown most gratifying results. Since the State itself owns less than one per cent of the forests within its borders, it has been the policy of the State Forester to support and encourage the interest of private owners in the practice of forestry, and in this way serve the public interest. Many owners who have taken advantage of this aid, have found woodland management and forest planting both practicable and profitable.

The replies received to questionnaires sent to all persons who have indicated an interest in forestry in the past, show that 114 active cooperators, including 11 municipalities and public institutions, have practiced intensive forestry methods—including improvement cutting, close utilization of products, as well as fire protection—on approximately 10,000 acres, while 40,000 acres more under the same ownership have been protected and improved to some extent, and definite plans made for more intensive management. The same cooperators, together with 41 others, are planning to extend forestry management to more than 12,000 acres of woodland that have received no special attention up to this time.

Progress has also been made in forest planting. While natural reproduction is usually adequate and satisfactory in most parts of the State, it is often advisable to reestablish forest growth by planting on land unwisely cleared and unfit for agriculture, or where all reproduction has been destroyed by fire. More than 1600 acres have been planted by persons cooperating with the State Forester, and nearly 300 acres more will be planted within a short time.

Believing that a number of State forests are valuable as public demonstrations of the methods and results of forestry practice, the State has acquired six public forests with a total area of 16,591 acres. Upon these lands 50 acres of forest plantations have been set out for the purpose of experiment and demonstration.

Altogether there are 80,000 acres within the State, approximately 4 per cent of the total woodland area, upon which forestry practice is

now established or definitely planned for the immediate future. The owners have been won over to a realization of the importance and practicability of forestry methods and are pledged to its practice.

The progress indicated in this survey is encouraging when it is realized that the work was begun only 13 years ago. Much, however, is yet to be done. New Jersey has nearly 2,000,000 acres of woodland, most of it in a degraded condition because of repeated forest fires, wasteful logging, neglect of owners, and abuse by the public. As determined by soil surveys and careful studies nearly three-quarters of this area is unfit for any profitable use other than growing timber. The State's problem therefore is to make this great area a group of productive, profitable forests; the means clearly are preventing and controlling forest fires, and applying practical forestry management. These established, the value of New Jersey's forests can be rapidly increased from the present total of 6 million dollars to over 200 million dollars. Instead of furnishing less than one-twentieth of the lumber used within the State as at present, New Jersey's woodlands are capable of supplying a large part of the ordinary lumber and wood products required by her people. The benefits to land owners, producers and consumers are self-evident.

THE SYRACUSE CRUISING CHAIN

A new adaptation of the slope chain, operated in conjunction with Abney hand level for the obtaining of horizontal and vertical control on cruise lines in timber surveys, is in use at the New York State College of Forestry, under the name of the Syracuse Cruising Chain. According to the idea of its designer, Professor H. C. Belyea, of the Department of Forest Engineering at Syracuse, the chain is one which can be used with any one of the standard slope measuring instruments, and is not restricted to the use of only one elaborately co-adjusted instrument. Primarily it is adapted to the standard Abney clinometer, the utility, accuracy, and general use of that instrument being recognized.

The chain used for the purpose is a standard band chain, two chains in length, graduated and sub-graduated as such. At the end of the band chain there is a 30-foot trailer, so graduated that the inclined distance on any slope which corresponds to two chains on the horizontal may be set off directly on the chain in accordance to the angle of slope

as read on the vertical arc of the clinometer. At the points on the trailer, designating the slope correction distance there is engraved a statement of the difference in elevation in *feet* for two chains of distance and that particular angle of slope. Its use accomplishes the establishment of two important operations in forest mapping in one unit operation, namely, (1) the establishment of true horizontal distance, and (2) the obtaining of true difference in elevation in feet for the carrying forward of absolute elevations and the sketching in of true contours as they appear on the ground. The special advantages urged in favor of this slope chain is its adaptability and simplicity.

Dr. C. A. Schenck, in an interview by Gordon Dorrance, in the New York *Evening Post* of April 3, made the following interesting statement:

"German forests continue an A1 asset. Our forest policy has been a conservative one. It reaps today what it has planted. Were it not for these forests the coal situation would fail of solution. Our present forest policy continues too conservative for me. If there were ever a time to empty the nation's savings box, that day has now arrived. Where forests stand on farm soil they might well be converted to farms. The paper price of forest products is high. Spruce logs sell in the woods, 15 miles from the nearest railroad, at 2,000 marks per 1,000 board feet. Timber fit for furniture is beyond the reach of people. The forest authorities, nevertheless, do not cut more even now than the 'sustainable yield.'"

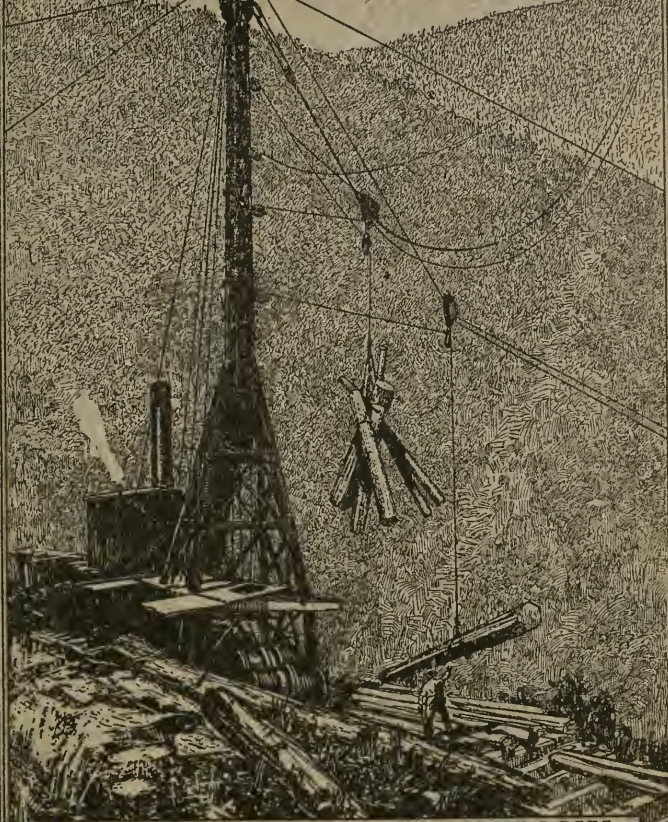
A. B. R.

An official guide to the Forestry Section of the Museum of Economic Botany of Kew Gardens has lately been issued; price, 2s. net. The object of this section is to direct attention to British forestry and the scope of the objects has been limited to collections of timber, fruits, and seeds of trees, dried specimens of a few types of hardy trees and shrubs, photographs of isolated trees, plantations and natural regeneration of trees, the fungous and insect diseases of trees, articles manufactured from British grown timber, and tools and machinery used in silvicultural and arboricultural operation.

In recognition of his services to the Dominion and to the University of Toronto for the last twelve years, the university has conferred the degree of Doctor of Laws on Dr. B. E. Fernow.

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"GENE" IN ACTION

Eugene Sewell Bruce

In the death of Eugene Sewell Bruce, June 7, the foresters have lost a man unique in the history of American forestry, a pioneer builder of forestry in this country, and a wise and practical leader of the profession. The early growth of forestry in the United States was intimately bound up with his practical guidance and wise counsel. Bruce came in contact with forestry during the first work of the State and Government in the Adirondacks. At that time he was recognized as one of the most efficient of the practical lumbermen of the north woods. Twenty years ago, when Bruce abandoned a career rich in promise as a lumberman in private employ, there was a little band of foresters in Washington filled with enthusiasm, but void of experience. Into this band he came, at a real sacrifice to his own financial future, bringing with him a clear vision of better handling of the forests which he loved, and a grim determination to see this better handling realized. His ability to grasp what foresters were thinking about and his intimate knowledge of the difficulties in their path, made his services of inestimable value. He was the necessary connecting link between foresters and lumbermen, and by smoothing off the many rough points of contact between the two, he led foresters to understand lumbering and lumbermen to apply forestry. He was quick to grasp the conception of forestry, its place in the ultimate development of the forests and its relation to the practical side of the lumber industry. In those days he was perhaps the one lumberman who saw clearly that the vision held by foresters must soon be realized, and to the realization of this vision he gave the better part of his life. He believed in forestry. He believed in forestry so firmly that largely as a result of his own efforts lumbermen are now practicing forestry wherever Government timber is harvested. To those of us who are still plodding along the trail his loss is softened by the knowledge that he lived to see the accomplishment of his aims. He brought his vision down to earth and made it work.

From the very beginning Bruce was directly connected with many different phases of forest work undertaken by the Service. Before the days of National Forests he assisted as no other man could in the preparation of working plans for private timberlands. When the public forests were turned over to the Forest Service his advice in framing the timber-sale regulations was indispensable. Probably his greatest service of all lay in his supervision and inspection of the many active timber sales, for into such work he carried the hard-headed experience of one brought up in the lumber industry itself, to which he added an adequate understanding of what foresters were after and a rare tact for accomplishing the results desired. On more than one occasion in those early days it was Bruce who saved the day for forestry. In more recent years his time was occupied largely on problems connected with the acquisition of lands under the Weeks Law, and in this field he served with marked success. He placed public interests above his own personal advantages and with the zeal of a new convert to a great cause fought for them courageously, without sparing himself in the face of opposition and antagonism.

Into the ranks of foresters he brought those traits characteristic of a strong man schooled in the lumber woods—self-reliance, ingenuity, persistence, confidence in his own judgment, and the tendency to hang to his own point of view and fight for his principles to the bitter end. His sterling qualities, his straight-forwardness, integrity, and fairness commanded the respect and admiration of even his worst antagonists. To foresters that is precisely what made him so lovable. In spite of his many brisk tilts with the young foresters, there was always the profoundest mutual respect between "Gene" Bruce and those to whom he was intimately known. He has left his mark upon the foresters of the country. There is no other like him.

On behalf of the Society.

HENRY S. GRAVES.
GIFFORD PINCHOT.
RAPHAEL ZON.

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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

WHERE WE STAND

BY GIFFORD PINCHOT

It is no easy matter to agree upon a national forest policy. The problem is so large, complicated, and far-reaching as to justify honest differences of opinion upon the subject, especially in relation to details of method. The time allowed the Society for discussion and decision has been all too brief, although the arguments advanced have served to bring the basic factors of the situation vividly into view. Foresters have become intensely interested in the problem, and that fact alone has made the game worth the candle.

The agitation of the past six months has brought to light several things of striking interest:

1. There has been no serious attempt whatsoever to controvert the facts of the forest situation as stated by the Committee for the Application of Forestry, facts based upon statistics furnished by the Forest Service. Foresters, lumbermen, and the public have tacitly admitted that the forest conditions of the country have been correctly described and analyzed.

Doctor Compton, to be sure, showed an inclination to differ with foresters as to the meaning of the forest situation in his original article on the fourteen points; but his paper in the March number of the JOURNAL OF FORESTRY is (thanks to Mr. X) a fairly successful effort to crawl from under.

As a matter of passing interest, Mr. Dunham's report on the yellow pine situation in the South (a report undertaken for the lumber industry) verifies closely the figures of the Bureau of Corporations and bears out the statements of the Forest Service and the Committee to the effect that the bulk of the original stands of yellow pine will be gone within from ten to fifteen years.

2. The great majority of foresters now appear to be reaching the conclusion that some form of compulsory legislation is the only alternative to forest devastation. The sentiment as to whether national or State control should prevail is less definite. When the Committee's report first appeared it was largely misunderstood; but the recent swing toward giving it favorable consideration is clearly marked.

3. The public, as yet, views the whole problem through a somewhat hazy atmosphere. It is decidedly interested, but lacks readily understandable information. From what it does know of the situation it takes for granted, apparently, that the nation should handle, and is going to handle, the job.

4. There can now be but few foresters who believe that material improvement will result from the voluntary cooperation of lumbermen. If surface protestations are disregarded, and from past experience we are fully justified in disregarding them, it is clearly evident that the lumbermen have no intention whatsoever of cooperating with foresters—unless it be on a plan so sterilized as to be useless. The recent Lumber Congress at Chicago merely emphasized the almost unbelievable inertia of the industry. Was there need for action? Perhaps, but merely to smooth over the present unjustified ripple of public sentiment against the industry. If anything needed to be done, it would be done by the industry itself, which was quite able to handle the situation without suggestions from beyond the fold. The public would gladly entrust the safeguarding of its interests to the very industry that is now disregarding or working against those interests—a supposition involving sublime confidence in the credulity of the people of the United States.

Mr. Mason is one of the few foresters who still clings to ancient legends. His view, as expressed in the March JOURNAL, resembles the innocent belief we all held some twenty years ago, the belief that the lumbermen would gladly cooperate with us foresters whenever a good chance really offered. Unfortunately, the test of experience has betrayed our hope. Mr. Mason, I fear, still lives under the spell of gentle flattery and lip profession which held the rest of us so long. His article closely follows the arguments advanced by the lumberman-forester who guards so efficiently the interests of the organized lumbermen in the Northwest.

The principal arguments against the plan of the Committee may be briefly touched upon as follows:

CONFISCATION

Certain lumbermen in California and elsewhere have objected to Federal control of the harvesting of forest crops on the ground that the costs imposed might be so heavy as to amount to confiscation. The same argument, of course, would apply against State control.

It is admittedly conceivable that a government bent upon confiscation might impose regulations so costly as to confiscate. Is there a single example, however, under either Federal or State control, where charges have been so high as to amount to confiscation? If so, I am not aware of it. In practice precisely the opposite commonly takes place. The charges imposed have usually been too low—often far below the going market rates. Examples known to all of us are grazing fees, water-power charges, land rentals, etc.

We all know likewise that the costs of avoiding forest devastation are reasonable, and often merely nominal, on the National Forests, where timber has been harvested in commercial operations for many years under precisely the methods contemplated by the Committee and the Forest Service. The cry of confiscation is raised simply to divert attention from the main issue, which is the necessity for public control. The lumbermen are not worried about costs, but they are very much worried by the fear of any sort of regulation from the outside.

The Committee's plan involves the prevention of forest devastation only by the perpetuation of forest crops through natural reproduction—volunteer growth. It does not call for the planting of forest lands, although the owner would be at liberty to plant in case he preferred to keep his lands productive in that way. There seems to have been some misapprehension on that point.

CONSTITUTIONALITY

The constitutionality of Federal control may be brilliantly debated by the ablest lawyers for years to come, but there can be no conclusion until legislation is passed and a decision is handed down by the Supreme Court. All we need to know at present is that there are excellent reasons to believe that Federal control is constitutional on the ground of protecting the watersheds of navigable streams and the regulation of interstate commerce. It is fair to assume, also, that in case Federal control is essential the public will find a way to enforce it.

AMERICANISM AND DEMOCRACY

It is argued that national control is undemocratic and un-American. What is meant is not clear. We have National control of the railways,

of the merchant marine, of prohibition. Are these things un-American and undemocratic? National control was necessary because State control had failed. It is claimed, nevertheless, that because control in these cases started with the States, failed with the States, and was afterwards taken over by the Federal Government, so the regulation of forests must start with the States and later, perhaps, go to the National Government.

Americanism and democracy on this basis would seem to mean that, in spite of costly experience, we must hold to precedent, undertake what has failed before and is sure to fail again, and so waste years of supremely valuable time, at the end of which we may have little timber left to perpetuate.

We are all, or nearly all, agreed that the quickest and least costly advance in keeping forest lands productive will come from preventing devastation in the harvesting of the 2,500 billion feet of virgin saw-timber still remaining, the bulk of which will have been cut within the next forty or fifty years. Shall we deliberately plan to apply our most effective remedy too late?

So far as the forest problem is concerned, neither Americanism nor democracy are restricted by political boundaries. Local governments in towns, counties, and States may be far from democratic, and are frequently un-American. All too often they are controlled by boards and legislatures which are themselves controlled by politicians for political purposes, or by powerful special interests with a preponderating political influence. I believe it is fair to say that, compared to the average run of State or local governments, the National Government is distinctly more American and more democratic. It is undoubtedly cleaner and more efficient.

With the right sort of leadership and with thoroughgoing decentralization, national administration has been and can be intensely democratic. There are many examples—none better than that of the Forest Service itself. Professor Kirkland's paper on the subject, which follows this article, handles the argument so thoroughly that further comment here is unnecessary.

EFFICIENCY OF CONTROL

Few would argue against State control if the States would really control. The difficulty is that they would not, and the best proof of that is the constant desire of the men who are opposed to all control

to leave it to the States rather than the Nation. Moreover, the attempt to repeat the oft-tried experiment would be time lost, when time is a vital factor.

State legislation is relatively unstable. The failure of State forest legislation and administration is notorious. In the very regions where the prevention of forest devastation could come in time to count, the States have been, are now, and would hereafter be powerless against the lumber interests. Forest laws passed this year (if passed at all) might easily be done away with or emasculated in a year or a decade. When good laws have been passed, they have often been sterilized in the execution. States have seldom adhered to definite forest policies. I repeat that lumbermen, seeing some sort of control on the way, strongly prefer State control, well knowing that they themselves can control it.

Forest bills recently before the legislatures of Maine and New York are typical of what may be expected from the States. They would make the prevention of forest devastation optional with the private owner, a policy which experience has proved to be an utter failure.

National control, of course, is not perfect; but it is decidedly the best sort of control we are able to apply. Compared to State control it is proved by experience to be intelligent, skilled, stable, effective, clean, fairly free from political influence, and closed to pressure from special privilege. The United States Forest Service has demonstrated the truth of this statement, and the lumbermen know it.

An administration which places the harvesting of forest crops under Federal control and fire suppression under nationally aided and nationally supervised State control is workable in practice, if not ideal in theory. We are not aiming at perfection. We are aiming at results, the best and quickest results obtainable under the conditions which confront us.

NATIONAL BUREAUCRACY

The fear that the Committee's plan means the building up of an obnoxious national bureaucracy is groundless. To have yielded to this cry would at one time have destroyed the Forest Service itself. No army of field officers or clerks will be necessary. Many a lumberman already well knows what measures are needed to stop devastation on his own lands, and many more will discover for themselves how best to keep their lands productive. The one thing lacking is the obliga-

tion to act, and since the objects to be attained are interstate objects, that may best be supplied by the Nation.

Bear in mind, also, that whenever forest devastation has been stopped and bids fair to remain stopped on a given area of timber holdings, the plan provides for the withdrawal of Federal control. This provision, by the way, should be made mandatory on the Commission, so that just as soon as private owners have proved themselves capable of keeping their lands productive, future control would be in their own hands. Government supervision should be necessary as a temporary expedient only, unless by the continued fault of the lumbermen themselves.

FLEXIBILITY

The lumbermen and some foresters have raised a familiar to-do about the "iron-clad" regulations for the country as a whole which they conceive to be necessary under national control. This argument hardly deserves an answer. Of course there would be no fixed regulations for the whole country. The governing principles would be established by the Commission in Washington; but the regulations would be made and applied locally, in such fashion to fit the peculiarities of the forest conditions wherever forest crops are harvested. The Forest Service sells timber from the National Forests all over the country, in many different types of forest growth, under as many different forms of regulation. This is precisely the sort of national control which would be applied to private timberlands, a control so elastic as to be moulded to all possible forest conditions.

SELF-GOVERNMENT

Will national control interfere with self-government? The problem concerns national, not local, self-government. What Oregon does with its timberlands is of vital concern to Massachusetts, Kansas, and the whole Nation. Colonel Greely, in replying to the plea of the Board of Forest Commissioners of the State of Washington that the National Forests be turned over to the separate States, hit the nail squarely when he said:

"The problem of supplying this country with newsprint, lumber, and other forest products is not a State problem or a local problem; it is just as much a national problem as our railroad transportation system and our merchant marine."

BUSINESS PHASES

To most lumber companies the reports called for by the Committee's plan will not mean additional work, for they already prepare and submit such information to their own associations. The public is perfectly justified in demanding information on the essential facts connected with the business conditions of an industry vital to the public

interest. Thoroughgoing publicity is a fundamental safeguard against private extortion.

LABOR

The suggested creation of boards of employers and employees, for advisory purposes and for the conciliation and adjustment of differences, seems to have sent cold shivers down some backs. It is evidently shocking to imply that industrial relations might be improved, or to inject labor problems into a forest program. Does it make no difference to the practice of forestry how and in what spirit trees are cut, slash disposed of, and fire prevented? It does make such a difference that under unfavorable labor conditions the application of forestry would be almost hopeless. And is the public quite unconcerned as to a steady supply of lumber and other forest products? Evidently not.

The joint boards are proposed simply to afford machinery by means of which operators and workmen in the lumber industry may discuss and adjust their differences. The whole aim of the plan is to induce the industry to tackle and solve the problem of industrial relations, of its own volition and with due regard to the public interest. No one can deny that the lumber industry is in need of machinery to this end, for its backwardness in this respect is notorious. A study of the changes now actually taking place in the rest of the industrial world makes it plain that unless the lumber industry awakes to the seriousness of its own situation, it will find itself at no distant time in a very nasty mess.

TO THE SOCIETY

The fact that the Society of American Foresters has a question of this importance before it for vote and decision is one of the most encouraging things that has happened for many a long day. We had drifted somewhat beyond the realm of the practical and were in danger of becoming academically ossified. That foresters should use their full power of concerted opinion and action for the advancement of forestry in the public interest goes without saying. We have begun to be useful.

It is peculiarly fortunate, too, that every forester in the country, through this referendum vote, has the chance to express himself as a forester, cutting loose entirely from whatever employment binds or influences his work-a-day actions. Whether in Federal, State, town, or private employ the opportunity now comes to him freely to express his personal opinion.

Finally, the Committee is not under the delusion that the fate of its plan or that of the nation will be settled by the vote of the Society. The people at large must work the thing out. The Committee is more concerned with the hope that every forester will give its report the most searching thought, and vote upon it with an open mind, than it is with the result of the ballot.

THE DEMOCRACY OF NATIONAL CONTROL

BY BURT P. KIRKLAND

It is of timely interest to compare democracy in the States with that of the Federal Government. In the case of State democracy it is quite possible, I think, to show its actual workings somewhat as follows:

In the school districts the more capable citizens quite generally refuse to serve on school boards, with the result that men of mediocre ability are elected, with a consequent narrowing influence on the schools. This is true in general, except for the school boards of the larger cities, which are usually controlled by business men who are inclined to manage the schools from a class standpoint.

In county administrations the commissioners are almost universally of the politician type, since no one else is sufficiently attracted to run for election to these positions. The result is that county affairs are usually handled with marked regard to the personal political fortunes of the commissioners. The outcome is too well known to need explanation.

In State governments we have again the politician type as the one who, as a rule, finds it worth while to seek election, and State affairs are controlled by politicians chiefly with a view to political fortunes. The history of every State legislature is made up mostly of a futile striving of the people to secure the kind of administrative action they wish, action which is seldom attained.

It is a fair conclusion that in all these cases democracy, if indeed it can be called such, has so far been a relative failure. It is extremely doubtful, moreover, whether a better basis of State government will be attained in the future. Certain it is that large financial interests within the States generally have had a preponderating influence in State governments.

Comparison with the Federal Government brings out certain contrasts. The honor and dignity attached to membership in Congress usually brings into the contest for such honors men of real capacity and often much of the highest grade ability within the States. When it comes to the chief executive of the nation, there is no question that with very few exceptions the most able men the nation has had at its

command have filled the position. Therefore, the Federal Government, though sometimes autocratic in its methods, has usually displayed in comparison a very high degree of efficiency, and a higher administrative tone generally than can be found within any of the States.

Efficiency in itself may or may not be the real desideratum. As we are now concerned with a discussion of democracy, it must be affirmed that the degree of democracy within the Federal Government depends upon the spirit of the administration itself. At times our Federal Government has been conducted in a manner more autocratic than any other administration in the world; and then again in the most democratic manner. It is largely a matter of leadership. Cabinet officers, bureau chiefs, and other directing heads within the Federal Government who desire democracy in their departments find no difficulty in securing a higher degree of it than the framework of our State administrations will permit.

I take it that democracy means not only that we shall have freedom of speech, of assembly, and of the press for the common man, but that the voice of the common man shall be listened to with respect. Under this definition I consider that in the early days of the Forest Service there was attained a degree of democracy such as few of our State, city, and other local units of government have ever attained. At that time the ear of the higher officers of the Forest Service was always open to the advice of the field man down to the lowest rank. As the field man was in direct touch with the users of the Forests the national administration rapidly brought itself into alignment with the desires of those most concerned in the management of the National Forests, namely, the forest users and forest workers.

These principles have their direct bearing, of course, on the matter of State or Federal control of private forests. State efforts in the line of forestry have met for the most part with total failure. States which have built up a fair degree of efficiency in forest matters have often taken slumps later on to the lowest state of efficiency. The reasons for these failures are partly due to the situation in State administration discussed above, and in particular they are due to the control of forestry matters by people who do not know the field with which they are dealing. Federal departments have always found it necessary to employ specialists, and that is the long established precedent in the Forest Service. Given Federal control, with service by experts and democratic administration, things which are at all times within

reach, not only is the highest degree of efficiency possible, but the desires of the producer and consumer of forest products will be most fully met.

To secure these results the administrative machinery must not be too centralized. It should have a district organization similar to the Federal Farm Loan Board, Federal Reserve Banks, and other Federal administrative agencies recently established. The advantage of the Federal Government in this respect is that its districts can be given boundaries which are coincident with economic units, thus introducing uniformity of control throughout each economic region. State control does not lead to these results because State boundaries usually cut through such units and it has never been possible to obtain uniformity of action even in two adjacent States. Thus, in the Northwest, if the State of Washington tries to conserve its forests in a way which will entail some additional expense to lumbermen, the State of Oregon may continue to allow ruthless cutting in the same type of forests, thus giving its lumbermen a temporary market advantage.

Democracy is not a question of geography. It depends upon the spirit and character of administration, whether that administration is local or national.

DISCUSSION OF THE PINCHOT COMMITTEE REPORT BY
MEMBERS OF THE MISSOULA SECTION OF
THE SOCIETY.

By Fred Mason

The report of the Pinchot Committee for the application of forestry deals with a tremendous subject. Its object is one in which the general public as well as the lumber industry should be much more interested than it is. Well informed members of the lumber industry are probably as fully aware of the facts, if not more so, than many members of the forestry profession. Our appeal should be directed to the public, but should be made in a manner that will not antagonize the lumberman. We must bear in mind the fact that, however much we desire to see the principles of forestry applied in the woods so that there may be an adequate supply of forest products for the consuming public, it is the lumberman through whose mills our timber supply must pass before it reaches the consumers. The dealings of foresters will be largely with lumbermen in marketing the products of America's forests. The lumberman can do much to help us if his sympathy with the movement is enlisted. He can do much to hinder us from taking over his holdings if he chooses. It is with the lumber industry that we must work hand in hand in the application of our principles.

Why then should we set out on this crusade by denouncing the industry upon which we must rely to convert stumpage into useful products needed by the public? The Committee's report is unjust to the lumberman and will do little to enlist his sympathy with the movement for the universal application of forestry principles to the handling of his property. In the presentation of "The Facts" the lumberman is condemned for the way in which he has handled his labor problem. He is accused of generating labor troubles of dangerous proportions. The reader is left to infer that in some manner the lumberman, through his nefarious practices, is responsible for such conditions as brought on the recent coal strike or the threatened railroad strike, or has forced his men to join the I. W. W. movement in self-defense. Specific objection is made to conditions as they *have been*. The progressive lumberman today, at least in the Inland Empire, is doing much to overcome the objection to housing conditions. If the layman would visit one of the

typical lumberjack hotels or rooming houses sought out by the lumberjack in his visits to the larger towns, and then make a trip to one of the typical modern camps, the camp bunkhouse would be found the preferable place to live. Even when they were at their worst, the lumber camp housing conditions and sanitary arrangements compared favorably with many of those offered today to laborers on railroad and other construction or even farm work. Have they ever been any worse than in tenement districts in our most uplifted cities, where several families occupy the same room? Have the hours of labor been any more outrageous than the hours exacted today by the railroad companies of many of their employees? When a man entered a camp he knew about what to expect in regard to hours of labor. He was free to choose between the camps and other occupations where hours were shorter. What of the hours of labor required of farmhands and fire-fighters?

In many localities logging is a seasonal occupation, depending on winter weather in some places and on absence of deep snow in others. It is necessary to work men only a part of the year in the same manner as they are needed only temporarily by the farmers at harvest time, or by the Reclamation Service when it is constructing a dam or a system of ditches. The lumberman keeps up his skeleton organization, building it up in time of need in the same manner as the Forest Service when it enters the fire season or has a planting project on hand. Why, then, should we single out the lumberman to blame for the condition of his workers, who easily become "voteless, landless, womanless, homeless, and hopeless, and therefore discontented, restless, and sympathetic with destructively radical doctrines." Can we not as readily and with as much truth blame it on any of the other classes of employers mentioned above? Let me add that my experience in contact with the lumber industry has been that rarely is a good willing worker "fired" for trivial reasons, as is the general impression. Such workers are encouraged to stay and are given work to do whenever there is work to be done. Ten men quit in order to "blow their stake" for one who leaves because he is discharged. It is not because a given body of timber is logged off in a few years that labor is a constantly shifting stream, but because labor itself for the most part is restless and continually on the move. Neither forest destruction nor forest conservation will alter this. Trouble between labor and employers dates back at least to the time of the parable of the workers in the vineyard. There always will be dissatisfied employers and dissatisfied labor. An

agency established by the Government or otherwise might settle a specific dispute, but it will never create a spirit of perfect satisfaction. On behalf of the lumbermen, let me say that living conditions under which their men work have been improved vastly in the last few years. So much for labor, to which too much space has already been given.

Figures are presented by the Committee to show that the average mill price of news print paper has doubled, and that lumber has a little more than doubled in the last ten years. Is this done in order to show the result of our approaching timber famine? If so, then we are also well on the way to a general famine of foodstuffs, clothing, shoes, metals, and many other necessities; greater than all these is the dearth of willing labor. The first thought to occur to the casual reader of such statements regarding prices is that the lumberman must be one of our detested profiteers. The ground for entertaining such an impression is well prepared on the second page previous in the Committee's report, where holders of large tracts of timberland are charged with holding more than is wise to have in the hands of a few individuals who are reserving them for those incalculable profits due to accrue with the further advancement of the timber famine. If privately owned timber is being generally held for speculation, how shall we account for the statements reported by the Committee that while 86 per cent of the standing timber is privately owned, 97 per cent of the cut comes from privately owned forests? Surely not all this difference can be due to the more inaccessible nature of the publicly owned timber. If the profits are to be so incalculably large in cutting this reserved timber, let us presume that the public will share a liberal portion of the profits through the action of the excess profits and income tax laws.

The impression is created that the destruction of private forests through lumbering is a needless act on the part of the lumberman, due entirely to indifference, in spite of repeated warnings of the approaching timber famine. As a matter of fact, no one knows better than the well informed lumberman that standing timber is becoming scarce. He knows that there will be a famine if new timber does not take the place of what he cuts. If he is progressive, broad-minded, and patriotic he does not want to see the end of the lumber industry in America. He realizes and admits that he has not taken steps to perpetuate the supply. He has been looked upon by his neighbors as being engaged in an exceedingly lucrative business, a member of the

fancied lumber trust, and an individual or stockholder in a corporation whose capital is unlimited.

Reference to Colonel Greeley's "Report on the Lumber Industry" will readily show anyone who is interested that the profits in the industry have been very small throughout the industry as a whole. In the Inland Empire in particular the profits have not been sufficient to return even a fair rate of interest on the capital invested.¹ The present system of taxation places a heavy burden on the lumberman if he carries sufficient stumpage to last him even 20 or 30 years ahead. In many cases large tracts of timberland have become a questionable asset. Owing to heavy carrying charges the lumberman has felt obliged to liquidate his stumpage as rapidly as possible through his sawmill. He seldom has on hand any large surplus of working capital² which is free of debt and acquisitions of stumpage frequently have to be made through the issue of some kind of bonds or notes upon which interest charges become due at stated intervals. During periods of depression he cannot close up his plant and await better times, but rather is forced to meet the competition of other mills, all seeking such business as there is to be had, in order to maintain his organization and meet fixed current expenses.

Under these circumstances lumbermen in general do not feel that they can make investments whose returns will be deferred for a period of from 40 to 100 years and whose rate of return is less than the rate at which money can be borrowed for the purpose of making such investments, when at almost any time during the period of the deferred returns fire may destroy a portion or all of the investment, upon which so far there is little possibility of placing insurance.

Each measure adopted with a view toward forest conservation adds to the cost of logging. Some measures, such as fire protection of merchantable timber, with slash burning as a step toward fire protection,

¹For a certain group of representative plants in the Inland Empire cutting over 60 per cent of the lumber cut during the 6-year period prior to 1915, the earnings paid an average of 3.7 per cent on the average paid up capital, and an actual loss of 1 per cent when a reasonable depreciation and interest on debt is deducted.

²For 11 mills in the Inland Empire during 1914 with an aggregate cut of 242 million feet, interest at 6 per cent on borrowed money amounts to \$1.17 per thousand produced. According to the ratio between their assets of timberland and manufacturing plant, 62 cents is chargeable to timberland and 55 cents to manufacturing.

and close utilization of all merchantable material, have been adopted to a certain extent. The leaving of merchantable timber as a basis for a future crop, and the planting of logged-off areas involve a cost which the lumberman does not feel that he can undertake independently as a business proposition. He realizes the effect of the law of diminishing returns.

The lumberman's critics have generally had little knowledge or understanding of the economic conditions he has had to face. Let us suppose that his plant is a single band mill, with a capacity of 50,000 feet of lumber per shift, and is situated where he can operate it year-long, or practically 300 days, two shifts each, either by logging year-long or by having ample log storage, if his logging is a seasonal occupation. He then has a capacity of 30,000,000 feet yearly, requiring, let us say, 25,000,000 feet of logs. If he is to embark on a sustained yield basis with a growth of 1 per cent per year of sawlog material, he will need, according to the Committee's reasoning, a tract of some 2,500,000,000 feet of timber. Taxes on timberland in the Inland Empire prior to the war averaged about 23 cents per thousand of lumber cut for companies having a 20-year supply on hand. With a supply on hand good for a hundred years this would have amounted to \$1.15 per thousand. Fire protection by associations cost one-third cent per thousand of standing timber during the 10-year period prior to our entering the war. For such an operator as we have assumed this would have amounted to \$8,333 per year, or about 28 cents per thousand of lumber cut. This gives a total of \$1.43 per thousand of lumber cut and represents a cost amounting to nearly 4 per cent interest on the invested capital, or a greater amount than the net returns from sales of lumber. The investment necessary to produce 1,000 feet of lumber annually, as shown in the "Lumber Industry Study," is as follows:

Plant	\$15.90	
Lumber in yard, 78 per cent of cut at \$9.50.....	7.90	
Bills and accounts receivable, 30 per cent of shipments.....	4.20	
Stumpage (average supply)	2.30	
Stumpage, 4 x as much.....	9.20	
	<hr/>	
	39.50	\$1.43
		<hr/>
		3 2-3%

At prices prevailing recently this cost could easily reach \$3 per thousand now. Would you consider it unwise as a business undertaking to

increase your sawmill capacity to a point where this timber could be cut in 20 years instead of 100 years, and thereby save four-fifths of this carrying cost?

Taxes and fire protection costs must be met and paid currently. At present there is no feasible scheme of paying them with money to be realized from the sale of timber which will be cut 20 to 50 or even 100 years hence. Timber bonds are not so popular as they were some years ago.

If such a theoretical timber operator existed in this country, his mill would furnish employment for possibly 150 to 175 men. The sawmill town would be one of 100 to 125 families dependent on the mill. It could be a permanent institution to this extent, with the addition of a few tradesmen and the local demand for the products of a few small farms. In the woods would be needed a logging crew of 100 to 120 men, assuming animal skidding. Twenty-five million must be logged every year. If the timber were heavier than common, we might assume a stand of 20,000 per acre.

In case of clean cutting, this would mean a cut of about two sections annually. If it averaged 10,000 per acre, four sections would be cut annually. In case of partial cutting, leaving 20 to 30 per cent for future growth, an even larger area must be logged each year. This means that camps cannot be permanent. They must move from place to place. Men with their families in the woods must move their families every year or two, or face the option of being away from home continually for a week or more at a time. Under either of these conditions woods work is more or less unsatisfactory for family men at the present time. In case logging is a seasonal occupation there will be seasons when the entire logging crew is without work, while a larger force must be employed during the logging season. Then woods work would be abandoned by family men unless other work were to be had during the slack season. It would be necessary to fall back on the "hopeless" variety of labor. Thus even where we have attained the forester's ideal of sustained annual yield, we still have unsatisfactory labor conditions in the logging camps.

Referring back to the number of men needed for such an operation, we have a maximum of about 175 in the mill and 120 in the woods, or approximately 300 all told. With the present stand of timber in the country there is sufficient for about 100 such operations, and work for 30,000 men if all could operate year-long. What shall we do with the

rest of the two million people dependent on sawmilling, logging, and naval stores? And what shall we do with the rest of the 50,000 saw-mills in the country?

If we are to have forestry universally applied to private timberlands, we must first place ourselves in the position of the lumberman in order to understand the conditions under which he is working. Then, instead of condemning him in the public eye, let us rather show the public what needs to be done for him before we can reasonably expect him to undertake to handle his timberlands so as to keep them productive.

A yield tax system on timber with a very nominal tax on the land.

A means by which the lumberman may secure loans at a low rate of interest, the interest and principal to be paid when lumber is cut. These loans could be secured by the timber during its growth; the timber covered by some kind of fire insurance and fire protection, either Government or otherwise. Such loans to be applied only to the payment of additional costs under forestry methods.

Provision should be made for purchase or long-time lease by the Government or State of timberland and logged-off land suitable only for forest growth, the price paid for such lands to depend largely upon their forested condition at the time of purchase or lease.

These steps would go a long way toward solving the application of forestry to private lands. They would enlist the sympathy and interest rather than the antagonism of the lumberman. Further steps would doubtless be advantageous and might become necessary, but the steps described above should precede any other legislation.

A possible method of postponing the ultimate timber famine to which there has been given little if any publicity is that of teaching the public through an educational campaign the uses to which certain classes of lumber may be put and the uses to which other higher grades and classes should not be put, as well as the necessity of avoiding waste in the use of forest products. When a frame house is built how many odds and ends of boards and dimension material are left strewn about on the ground when the carpenters have finished their work? Have you stopped to think that this source of waste is tremendous in the aggregate? And who is it but the lumberman who has devised the standard house with lumber ready cut to put together, involving the minimum of waste? What becomes of all the old scrap paper? How much of it is saved for the making of lower grades of paper which otherwise must be made from fresh supplies of wood cut in the forests? If the short-

age of fencing material is so acute in the prairie regions, why not establish some forests of quickly growing species of fence post woods, such as atalpa, to meet the situation? The farmer who bemoans the lack of cheap white pine boards for fencing purposes does not arouse the least sympathy in the writer. If he wants to build a fence why should he not use something more permanent and substantial and leave the white pine boards for some other purpose for which a substitute cannot so readily be found? During the recent war many substitute foods were used which ordinarily no one would have thought of using. Why cannot the same methods of use be applied to many of the heretofore little used lower grade substitutes for good grades of lumber? A campaign along this line led by such agencies as the Forest Products Laboratory should help solve the problem of timber shortage. An embargo on exports and control of lumber consumption appears more feasible than control of lumber production as proposed by the Committee.

By Elers Koch

The plan of the Pinchot Committee is to my mind an idealistic plan to accomplish by the magic short-cut of paternalistic legislation an end which cannot possibly be attained except through a long period of adjustment, and the gradual working of the economic laws of supply and demand. It is, to be sure, a consummation devoutly to be wished to place all of the forest lands of the United States in a productive condition and under systematic management at one stroke, through the mandate of a legislative body, but big economic reforms are not and have not been accomplished in any such summary manner.

The production of agricultural crops in the United States could doubtless be greatly increased if every farmer raised pure-bred stock, and used the most approved methods of agriculture, but no one advocates legislation placing the farms of the country under the direction of a Federal commission with authority to specify his rotation of crops and method of working the land. The impracticability is recognized at once, and so the Government, through its experiment stations and publications, proceeds to raise the standards through the slow process of education, and when a hard-headed farmer becomes convinced that there is more money in it, he gets rid of his scrub cows and spreads his manure on the fields instead of leaving it to leach out in the barnyard.

So it is with the practice of forestry. It cannot be done under compulsion. Unless a timber owner's heart is in it and his pocketbook back of it, the practice of forestry cannot be enforced. Consider how difficult it is to enforce the terms of a timber-sale contract on Government land, and then imagine attempting to enforce Federal regulations in a logging operation on the operator's own land, and perhaps against his will and his financial interests. It cannot be done.

What are we going to do, then? According to the figures a timber famine is impending, the forest land of the country is being devastated, and the productive area constantly reduced. The long-time factor in growing a crop of timber makes it imperative to stop the devastation of the timberlands before it is too late.

Ninety per cent of the devastation of timberlands in the United States is due, not to unwise and unrestricted logging, but to logging followed by fire. If the fire situation can be handled, most of the cut-over lands will grow a new crop, perhaps not the best that a forester could produce through the best silvicultural measures, but with the element of fire eliminated we would not need to worry about a timber shortage. The natural second growth would keep most of the land producing until the time is reached when the land can be taken over for systematic forestry.

Why not, then, concentrate on the one problem of protecting the forests and cut-over lands from fire and leave the regulation and silvicultural management of the lands to the future? Compulsory fire protection falls in an entirely different category from enforced silvicultural measures. It is a necessary police measure for the safety of other timberland owners. No man can allow his land to burn without endangering the rights of others. The bull law of many of the Western range States afford a parallel condition. These laws prohibit a stock-grower from turning a scrub bull on the open range because to do so effects the interests of other stockmen, but none of these States attempts to specify what breed of stock he shall raise or how he shall handle his stock on his own pastures. There is a limit to paternal legislation.

Enforced fire protection on privately owned timberlands can be handled through State legislation, encouraged and aided through liberal Federal appropriations. If the timberlands are protected from fire their ultimate disposition will work itself out. If forestry can be made to pay private capital will be interested in it. If it does not pay

an adequate return, no compulsory legislation can force private capital into it, and the Federal Government and State will be obliged to acquire the bulk of timberlands of the country. The mere protection from fire is sufficient for the first step of stopping wholesale devastation of such lands as they are cut over. If our efforts are concentrated on this one phase of the problem, there is a much greater chance of success than if we attempted to put over with one stroke of the pen a complete regulation of the entire forest industry of the country, something which has not been and probably never will be accomplished for any other industry.

By John F. Preston

Without attempting to review the program itself, I must proceed with the criticism and argument in order to save space.

CRITICISM

I am willing to agree to the following principles: (1) The country needs a generous supply of forests. (2) This means the keeping of all forest lands productive, whether publicly or privately owned, with no fine distinction as to the ultimate use of the land for agriculture or forestry. (3) The devastation of privately owned forest lands now going on can, and must be, stopped. (4) Ultimately, the lumber business must be put on a permanent basis, which means a direct relation between the manufacture of lumber and the productive capacity of forests. In other words—sustained yield management of forests.

I cannot agree with the statement of principles which includes the following: (1) That the timber industry has wholly failed in the right treatment of forest lands, and that no help can be expected from this source. (2) That the States are wholly incapable of meeting the situation. (3) That private ownership of forest lands carries with it a special obligation not to injure the public. (This is considerably qualified, as will be noted later.) (4) That National control is the only solution of the problem.

ARGUMENT

This program of forestry seems to me to be fundamentally in conflict with the democratic principles upon which this Nation was founded. Individual liberty and initiative and the opportunity for the highest development of the individual are some of the foundation stones

of the structure. The Government under such principles is slow—and delays are very discouraging at times. Success can be attained only through education—by working from the bottom toward the top. We must convince the people (that is, a majority of the people), that a certain thing is right, and when that is done the thing is accomplished. In other words, the strength of public opinion and public conviction is necessary before any program can be put through and made a success. Take, for example, our public school system and the system of public parks. In spite of all the handicaps which our system of government entails, our public school system is always maintained and supported, as is also our system of public parks. The reason is that the people are convinced that education and public playgrounds are essential, and once convinced they do not hesitate to support the program and put the plans into effect.

I cannot agree that the lumber industry has entirely failed to meet the problem. I believe it is just as much interested (and probably more interested) in this problem of forestry than are the people at large. It has been my experience that there are just as many public-spirited, large-calibre men in the lumber business as will be found in any other industry. They are, naturally, looking out for themselves and for their own business interests, but even so, they are doing exactly the same thing that men in every other line of business are doing. They should not be blamed for this any more than we should blame the Wool Growers' Association for not taking a more active part in the forestry movement.

The continuance of the lumber business is dependent upon the continuance of the forests. Every lumberman will admit that, and to that extent he is interested in the continuance of the forests. The people themselves are as much to blame for the present conditions as are the lumbermen. This Nation very unwisely gave away exceedingly large bodies of timber at a very small charge. The lumber industry during that period of acquisition believed that its only salvation was to acquire large timber holdings. I feel that the lumber industry can, and should be expected to, share in the leadership which is necessary in order to get the forest production of this country on a different basis, and I also feel that the lumber industry will support any reasonable plan which may be worked out. It is wholly a question of who pays the freight. Certainly any plan for the public good cannot be saddled upon the lumber industry directly. It must be paid for by the consumers. In my opinion the lumber industry is ready to help solve the problem.

Furthermore, I believe that the individual States are just as able as is the Federal Government to put into effect the program of forestry. The people must be convinced that the program is right, and there is no danger that it will not be carried out. It means education and propaganda work so that the forestry program is understood and that the people are convinced that it is right. It makes very little difference, after it is done, whether the program is actually carried out by the Federal Government or by the States.

The inequalities which will arise in the programs of the different States have been held up as a reason why the individual States are incapable of carrying out a program of forestry. It has been said, for example, that Montana could not insist upon the piling and burning of brush if Idaho did not do likewise, because that would make an extra cost to the Montana lumbermen which would not be assumed by the Idaho lumbermen. I think this is largely a bugaboo and it really needs to scare no one. There are now very much larger differences in the cost of producing lumber in the various sections of the Northwest than could be created by the requirements of any reasonable program of forestry. There is a considerable difference in the cost of logging on the West Coast and in the Inland Empire, and in the Eastern Oregon country as compared with the North Idaho region. Even in the Spokane territory there is now as much as \$2 to \$3 per thousand actual difference in the manufacturing cost of lumber between different mills. There is, therefore, already a vast difference in the cost of producing lumber between different regions and between different operators, even in the same territory.

The question for the people in the individual States to decide is whether or not the continuance of the forest industry is sufficient to justify them in putting into effect some restrictions which may possibly interfere with the continuance in business at the present time of a few individual operators. If the people of Idaho, for example, think enough of the lumber business to want it to continue, it seems to me they would not fail to make reasonable requirements of the present operators, in order that that business might be continued, irrespective of what attitude the State of Washington or the State of Montana might take, and even if Idaho lost 25 per cent of its present business as a result of that action, the State would, in the long run, still be far ahead.

The Pinchot program says that the ownership of forest land carries with it a special obligation not to injure the public. I agree with that statement, to a certain extent. Certainly a private owner has no right to cause any direct injury either to the public or to his neighbor. For instance, he has no right (which is well recognized) to leave a dangerous slash through which fire may spread to adjoining property. Neither do I believe that he has any right to so dispose of that brush that it will actually destroy valuable forest wealth which is already established on the land. In other words, he has no right to devastate the land and actually destroy something of considerable value. Further than that I believe the obligation of the private owner does not extend. I do not believe he could be expected to cut his timber in any particular way or be required to save trees of certain sizes. That, I think, is a matter purely to be decided on the basis of the economics involved.

The private ownership of forest land is as much a public obligation as it is a private obligation. It is the duty of the public to create conditions so favorable that the individual owner will gain by acting in accordance with the public interest. The private owner cannot be expected to practice forestry until it pays him in actual dollars. He can be expected, however, to protect the public interest to the extent of the proper disposal of his brush, because that means the continuous production of timberland and it means the stopping of devastation—and that far the public can go—and I believe that we can get the co-operation and the help of the majority of private owners in putting some such a plan into effect. The minority will of course have to be forced, but as long as the majority is in favor of it the plan will succeed.

This whole question of whether or not the Pinchot program should be accepted is in my opinion a question of whether or not the attempt to put into effect a forestry program should be made by working from the top down, or from the bottom up.

I certainly am in favor of very strong Federal action. The Federal Government should give assistance, both financial and otherwise, to the individual States and private owners, and give them all sorts of encouragement, and should carry on a strong propaganda. The Federal Government, as I have expressed before, should act as a Big Brother in this movement and not as a slave-driver with a whip-hand.

The people in the individual States must be in favor of the program of forestry, or it will not work, regardless of any Federal law. It is,

therefore, the part of wisdom for the Federal Government to offer encouragement and substantial aid to any State which will meet the Federal Government half way in the program of forestry. This the individual State cannot do until the majority of the people in that State are in favor of the program.

The question is, also, whether or not we shall throw down the gauntlet to the lumbermen and tell them that we propose to fight them—that we cannot expect them to give us any assistance—and that we expect their antagonism.

The conservation of forests is a matter which is easily gotten before the public, and is a matter which the public is in sympathy with to such an extent that there is no question of success if the foresters and the lumbermen work together. There is, however, a very big question as to whether or not either, working alone and antagonistic to each other, will ever succeed.

The Pinchot program says, in effect, that the lumbermen have failed, and that the foresters must fight the lumbermen. It says, also, that the States are wholly incapable, and that therefore the Federal Government must get busy with a big whip and force both the lumbermen and the States to come to time. In my opinion this is an attempt to Prussianize American forestry. On the other hand, it is my opinion that we should take the lumbermen into our confidence and together work out a sane solution and together convince the people that this solution is the right one. After that is done, it makes very little difference whether the legislative program is actually Federal or State. That can be determined by the future. The thing to do now is to convince the lumbermen and the people, and therefore the States, that the program of forestry and the principles of forestry are right. In other words, let us have American forestry in America, or have none.

I am confident that the American system is the right one, and is the only one which will ever succeed in carrying into effect the program of forestry or a program of anything else.

By J. A. Fitzwater

It is felt that throughout the entire plan too much stress is put on the alleged devastation by the lumbermen. It is true much young and immature timber has been destroyed, but such destruction cannot honestly be laid at the door of the lumberman. The lumberman in the

past has not been a forester, and there appears to be little reason why he should have been interested in the practice of forestry. This is especially true here in the West, where the cut has been almost entirely in large-log material. In the Northeast, where paper and novelty manufacture have been carried on, the use of smaller material has been possible and the realization of the possibilities of sustained yield brought closer home.

Furthermore, it is believed that the devastation in Idaho and Montana is not nearly so great as generally conceded. In Montana in the yellow pine type I believe between 40 and 60 per cent of the areas cut over have been left in a productive state—not intentionally, it is true, but still in the mature stands probably in as good condition as if silviculturally treated. In Idaho the results have not been so good, but neither have our own results been satisfactory. With the great mixture of species, the fire menace, and the predominance of overmature stands, leaving the land in a productive state is no simple problem. The State law in Idaho requires that slash be disposed of, and in complying with this law much immature growth has been destroyed. However, this growth has been largely made up of inferior species, and the system of broadcast burning was largely the same method we would have used. The agricultural lands sold more readily if partially cleared than if left otherwise. These lands, when cut clean and burned, come up to white clover and afford good grazing, making it possible for the new settler to handle a few head of dairy stock and so obtain some source of revenue during the period of development necessary to bring the raw lands to a productive state. The idea of keeping undeveloped lands productive up to the time of their actual economic need is probably a good one; however, in the management of such lands we have until the immediate present been just as guilty as the lumberman.

The entire plan of Federal control appeals to me, though there are parts of the plan proper which I believe are more drastic than necessary.

In establishing regional administrative organizations, I would like to see the Federal law so worded as to make the regional foresters responsible through their assistants for the actual accomplishment of the work on the ground. That is, that Federal officers actually decide the plan of cutting to be followed and have immediate direction of it; the same thing would apply to brush disposal. It is results we are after, and I cannot make myself believe we would get them any other way. The

cost of this work would come from Government funds. The increased costs to the operating company through proper brush disposal methods, and logging under a silvicultural plan, would be added to the cost of the lumber. The plan of checking costs and profits of the operator does not appeal to me, as it seems to spell control of the lumber industry. Such costs as it may be necessary to add to the price of lumber can, I believe, be left to the lumberman, providing States with similar conditions be grouped and the law so framed as to allow the necessary latitude. Certainly to have such a matter handled by individual State laws would work an unwarranted hardship.

On lands carrying selection stands the immature growth reserved would at maturity undoubtedly pay for itself. It is questionable how much present loss would be entailed in such stands anyway due to the increased cost of logging small material. Also most of these lands should be acquired by the Federal Government by the time they reach maturity, and, if so, the Government will be willing to pay for such material.

While in putting the plan over, States' rights are to be considered, I believe we will never reach our goal without Government control—at least not until it is too late. A number of States which are heavy users of wood would have no vote in deciding on whether we want forest regulation or not (if handled on a State control basis). As citizens of the United States they are just as vitally interested as are the citizens of the States growing the timber. The timber States are largely controlled politically by the lumber interests, and it would be difficult to put laws in effect not satisfactory to such interests. Also political administration of a timber-growing plan would be extremely unsatisfactory, and past experience with the enforcement of State laws does not encourage one to look forward to satisfactory results.

I feel that such Federal control measures as are necessary should be considered as a temporary expediency only. I am in favor of Federal acquisition just as fast as funds and conditions allow. Where States and individuals desire to practice forestry, they should certainly be encouraged and allowed such an opportunity, but only so long as they show they are bona fide in their intentions and qualified to do so.

By requiring that forest lands be kept productive, we will have real forest lands to take over under acquisition. It is hardly expected that potential forest lands can be acquired by the Federal Government in the immediate future, but rather over a period of, say, 20 years. Our big job now is to have something which will be desirable to acquire when the time comes.

COMMENTS ON THE FORESTRY PROGRAM¹

BY E. C. SHEPARD

Private Forestry, A Policy of Forestry for the Nation, National Lumber and Forest Policy, and other similar titles are being given front page space in forestry publications today. This movement, which has been fostered during the past year to such a large extent by the Forester for the United States Forest Service, is not a new idea in this country. During the past years many foresters have called attention to the need for a comprehensive policy of general forestry for the nation. There appear to be a number of reasons why a nationwide campaign to put such a policy into operation should logically be inaugurated at the present time:

First. The shortage of timber supply is beginning to be noticed in certain quarters, particularly in the matter of newsprint stock, which, while affecting only a small part of the lumber industry, vitally affects the whole nation, and is something that catches the attention of the public.

Second. The unqualified demonstration during the war of the vital uses of wood and wood products. This was coupled with an equally convincing demonstration of our inability, even with our present resources and facilities for production, to supply the demands of the war in a satisfactory manner.

Third. More or less public attention has been directed to the part which France played in supplying timber for war needs, not alone for her own armies but for those of the allies as well. Many of the foresters from the United States who were in France during the war have returned with the conviction that we should inaugurate immediately a policy that would put us in a position to supply the future needs in a manner comparable to that by which France has shown the wisdom of her National Forest policy.

Fourth. The war demonstrated as nothing else has done in the previous history of our country the tremendous possibilities of organized effort along any line when once the public is sufficiently aroused to the need of action. The opportunity thus presented to take advan-

¹ Paper read at a meeting of the Intermountain Section of the Society of American Foresters, at Ogden, Utah, January 23, 1920.

tage of the spirit of the times doubtless had considerable weight with those who decided to start a Forestry Program at the present time.

Admitting then that this is an opportune time for the inauguration of a definite program, we only need pause to remark that the underlying principles which call for such a program are sufficiently well understood in a general way by the people of the United States today, particularly by foresters, and that no further elaboration need be made of the reasons why the nation-wide practice of forestry is held to be fundamental and vital to the ultimate welfare of the nation. We do most assuredly need, however, much more thought and study as to the means by which this essential end is to be accomplished.

The following observations on the situation are merely the result of a casual review of the current literature on the various plans put forth by foresters in the United States during the past year, and do not in any way represent a thorough nor comprehensive study of this tremendous problem.

The Society of American Foresters, feeling that the time was ripe for action, appointed several months ago a Committee to recommend a Forest Policy for the Nation. The report of this Committee is the most specific presentation of the issues that has yet been published. There are two striking facts in connection with this report to which it is desired to draw attention.

The first one is that this Committee is essentially a committee of technically trained foresters, and does not represent the lumber interests. Any program of forestry for the nation will involve private interests to the extent of about eighty per cent of the standing timber and the same percentage of the forest land. Such a gigantic undertaking involves so great a variety of economic interests that no group of foresters can expect to formulate a workable policy without the cooperation and support of the lumbering industry: in other words, the private interests which will be most affected by any such program.

The other significant point in connection with this report is that the foresters, those who were assigned the task of preparing the program, are not in agreement among themselves as to the form which such a policy should take. It would seem that before attempting to present a concrete proposition to the people of the United States, we should at least have reasonable accord among ourselves as to what such a program should include. "When doctors disagree the patient usually dies." We have no such fears in this case, but unless concerted and cooperative efforts are put forth little hope can be offered for a com-

plete recovery. In the opinion of some of the lumber journals, the "doctors" represented by this Committee have diagnosed the case, condemned the patient for allowing himself to get in such condition, prescribed the remedy, and presented the bill, without ever having been summoned in the first place to prescribe for the patient. One of the biggest mistakes that can be made during a consideration of the issue is to criticise the lumber industry for the present situation, and to charge it with responsibility for all the bad practices which have been followed in the lumber world during the development of the country.

Others have called attention to the fact that the basic error was the policy of the Government in past years in allowing the title to timberland to pass so freely into private ownership. The lumbermen of today are assuredly not responsible for that, nor are they responsible for the complex economic conditions which have made it necessary for them to conduct their business on the basis on which it has been conducted. Under the economic conditions which have existed during the past quarter of a century the exploitation of our lumber resources has been inevitable. We cannot condemn capital for not retaining cut-over forest lands and making provision for another forest crop when such a policy is not financially practicable.

The history of financial enterprise in the United States shows that wherever there is any reasonable assurance of monetary return, capital is ready to invest, and it is idle to argue that the lumbermen of the United States have not been alive to investment possibilities in this respect. Even though there may be honest differences of opinion as to the responsibilities of the lumbermen, it is most certainly worse than futile to subject the industry to such attacks as have occasionally appeared in the *JOURNAL OF FORESTRY*. When a scientific journal which represents the professional foresters of the United States comes out with a statement that "lumbermen, the private owners, are as a class, distressingly stupid," we can hardly expect those same lumbermen to respond agreeably to a program which involves an extensive reorganization of their industry, and which in fact might have disastrous results to their financial interests.

The recognition by the Government of the essential fact that proper forest management requires the financial support of the nation gives promise of the ultimate success of the movement: the lack of such support would have resulted in ultimate failure. The one great reason for the lack of success of past efforts in the direction of applied for-

estry is our failure to realize that forest management as a financially possible undertaking cannot succeed without some form of government subsidy. That is why "we have forestry everywhere except in the woods." Forestry has never succeeded in other countries without some form of Government support. If the conservation of our forest resources is essential to the welfare of the nation, as we believe, is it not worth something to us in dollars and cents, and should we not be ready to concede that fact and take action accordingly?

Other industries of at least no greater value to the nation have already been fostered by Government support. Men who have studied the sugar-beet industry, for example, state in no uncertain terms that that enterprise has never been able to stand by itself in any country, but must have governmental aid in the form of a discriminating tariff, reduced taxation, or some form of subsidy. If the raising of sugar beets (which improves the quality and value of land, gives large employment to labor, and enables the country to be more self dependent) is worth enough to the nation to justify the expenditure of public money for the support of the industry, most assuredly then the many advantages of forests, which need not be enumerated here, would justify even to a greater degree the financial support of the nation.

A review of past policies in the United States in regard to essential industries nowhere reveals a case where private enterprise has been forced into an undertaking which does not offer financial remuneration, even though it may be an enterprise vital to the whole nation. Even during the stress of war, we did not ask any industry to produce for the nation at a financial loss. We needed wheat, meat products, and many other commodities, but we did not demand that they be produced at a financial loss to the individual. To the contrary, the Government took steps to see that the producer was adequately rewarded.

The growing of forest products involves a number of elements not found in the production of other agricultural crops. They include such things as long-time investment, the risk of loss by fire and other causes, the uncertainty of future yield and prices, and the irregularity of returns on the investment.

The various plans for making forestry financially remunerative, such as increased protection from fire, and a reduction in taxation, do not meet the fundamental difficulties indicated above. In other words, the practice of forestry by private interests is a difficult undertaking, and while it may succeed in certain specially favored localities, with the support indicated above, such unaided efforts can never solve the problem in the United States. Government ownership of all forest

lands while overcoming some of the foregoing objections brings certain others in their stead, and involves a tremendous expenditure of money during a short period, if put into practice on a large scale.

In the May, 1919, JOURNAL OF FORESTRY, W. N. Sparhawk brings out a new plan under the title of "How Can the Private Forest Lands be Brought Under Forest Management?" He recites the objections both to private ownership and to straight Government ownership, and suggests a plan of private ownership with Government operation. The points in favor of such a program appear so great as to make it the most feasible solution of our problem that has been presented to date. It is considered significant that a similar program has been recommended by government interests in England as adaptable for a solution of their forest problem.

That some headway is being made in the way of provision for a future supply of special products is indicated by a bill recently introduced in the Senate by Senator Poindexter of Washington, aiming at an assured future supply of pulpwood. This with other activities indicates that we as a nation are beginning to realize the situation, and that some progress is being made toward the solution of the problem. However, these isolated attempts at forestry even though coupled with active propaganda by foresters throughout the country, should not lead us to the conclusion that our forest problem is solved and that all we need is an act of Congress. To protect the present stand of timber and the growing stock, thus providing for ultimate renewal, is really only the beginning of forest practice although a vital and fundamental one.

In discussing our forest problem we should be exceedingly careful not to indicate that we expect and demand immediate action on a wholesale scale, nor to indicate in any way that immediate benefits will result from immediate action. It takes many years to grow a forest, and it takes many years to develop a forest policy. It took France hundreds of years to develop her forest policy to its present state, and France can certainly show a greater solidarity of interest than can the United States. Furthermore, her forest area of 25 million acres is equal only to the forest area of the New England States. We can hardly expect, therefore, to put into practice a complete program for the proper management of our 500 million acres of forest land within the short space of a single generation. We should not lose sight of the fact that this nation has been really cognizant of the need of forestry for only a quarter of a century. Such need has really been brought to the front only during the past fifteen years, or during the time of creation and development of our National Forests as they are to-day.

The foregoing may seem a pessimistic and damp-spirited view of the situation, but we in America are notoriously impatient of results, and we need to keep in mind the fact that should some national forest policy be put into operation to-day, none of us would live to witness to any appreciable extent the material benefits of such an undertaking.

REFLECTIONS ¹

BY AUSTIN CARY

The talks made thus far this evening remind me of a story I heard at the recent Southern Forestry Congress. Once on a time an old southerner had a pack of hounds of which he was proud, especially of one particular animal. This hound was very swift, and a little heedless withal, through which combination of qualities he finally met disaster. Following the trail one day he ran square into a small, erect, and rigid sapling, the force of impact being such that the animal was split into two halves, from the tip of his nose to the tip of his tail, completely. The owner coming up was caused much sorrow but soon a happy device occurred to him. He picked up the two halves of the dog and fitted them together, but, due to haste, in a position reversed from the natural one. This, however, proved to be an advantage in a way, for the dog could run both ways and bark at both ends thereafter.

The parallel I have suggested appears to me to hold in this way and to this extent, that a number of the speakers have expressed great appreciation of the personal qualities and professional authority of the authors of this report, acknowledged that they have formulated some valuable principles, but then have proceeded to state some strong objections and disagreements. I expect to follow the same course myself in a general way, but in accordance with a temperament recognized, as I understand, as a downright one, also in view of the lateness of the hour, what I shall actually have to say here will be mainly in the latter direction.

In the first place, I disliked the circumstances in which the report was formulated. A group of men representing concentrated and technical interest in the subject matter appeared to go off by themselves to formulate a policy on this great subject for the country. It has seemed to me a subject too big and too involved for that—one touching too many interests. I approve heartily of the position taken by Mr. Bruce in his postscript, and feel that Colonel Graves' whole method of going at the matter is much sounder—to start the thing moving, to appeal to patriotism, to invite cooperation and counsel. Possibly in this I do injustice to the real intent of the Committee.

¹ Remarks made at a meeting of the Washington Section of the Society of American Foresters, March 11, 1920.

But I think I see in the report itself many features that result from this origin. Aside from the general character of the solution that has been presented, a matter which has been covered by others, I see at many points statements which I consider overdrawn, or at least unbalanced, not given in true perspective or relation, hence to the reader not intimately informed, misleading. Such a treatment of an important subject is sometimes justified on the ground that the end sanctions the means. I do not suppose the Committee takes that view, but rather that what seems to me partisanship results from their training and viewpoint.

I will not specify on this head, for time lacks, and others to some extent have done it already. I do wish, however, to point out two points in which I think the basic figuring of the Committee is to be questioned, and that is the more important because we have not yet got to the end of this business; much more figuring of this kind has got to be done, and it certainly seems that we ought to be sound with our arithmetic.

Let me, for one thing, refer to the first half of page 926 of the report of the Committee as printed in the *JOURNAL OF FORESTRY* for last December. It is stated there that 35 billion feet is the yearly growth of timber in the country. The basis of that statement is not given, but that point will be passed over. What I am concerned to develop is that this 35 billion is stated to be growing on one-half the forest area of the country, the better class of cut-over lands, a hundred million acres more of the same class not being considered worth figuring on, and 150 million yet in virgin timber being omitted from consideration also. The point that appeals to me is that with extension of fire protection and perhaps other helpful measures that seem to be attainable in the early future, the hundred million acres should be given some weight; also that the productive power of the lands now in virgin timber, when once they have been cut over, should not be neglected. Just such figuring as this, if my memory serves, was at the basis of that old 3-to-1 statement that has had such wide currency. I have always thought it misleading and faulty.

For the next point I will refer you to the paragraph bridging pages 919 and 920 of the *JOURNAL* for December, and, to compare with that, to statements that Mr. Kirkland, who signs this report, has made in other connections, in the *JOURNAL* for March, 1917, page 294, and on page 28 of the *Lumber World Review* for January 25 last. Each may draw inferences for himself. On my part I have inferred that little

weight is to be placed on computations which bring out such diverse conclusions from the same data.

But the Committee seems to me to have subordinated to far too great an extent one main aspect of the matter. The topic in mind I can illustrate by recounting something that happened to me years ago, more than 25 years certainly, in the early days of my connection with forestry. Maine was my field then; I was advocating careful and conservative handling of spruce timberlands, and in the course of conversation some plain but clear-headed man remarked that if I owned a township of such land no one would make any objection to my handling it that way if I wanted to. And the fact is I might have done that very thing. Take a specific case and see what might have resulted from it. About 1895 a Maine sawmill concern, having cut over a half township that they owned, objected to the tax valuation of \$5,000, told the State assessors they would not only sell it for that but pay a bonus to anyone who would bring them a customer at that figure. I knew of this occurrence, had been on the land, and knew there was a lot of growth on it; also I had the money and might have bought it. It started some pointed thinking two or three years ago when I learned that, after yielding heavy revenue meanwhile, the same tract had lately figured in a deal at \$25 an acre.

Now good, careful handling of that tract would have been forestry, would it not? And I think it must be clear that the same thing would have been profitable. That understood in a broad way, the question arises in my mind: Why should not foresters manage a large share of our timberlands in this direct, natural way, and in so doing insure that, as far as practicable, the principles of their profession are put in practice?

I can answer in my own case, and will. For one thing I was too single-mindedly bent on the development of forestry in the way in which most of us view it—as a great public interest—to be satisfied to be in it solely as a matter of profit. I do not now regret my course, and, that being the case, certainly have no fault to find with the man whose temperament and qualifications lead him in the same direction.

But I think there was another element in the matter, too—that I didn't have the vision and nerve to do it. In other directions I had enough, for it took both for a man to throw his interests in with forestry in those days, but for this particular thing I hadn't. And the same considerations have held since, for time and again in my career I have seen opportunity to do profitable business and put forestry in

practice at the same time, yet stuck to the line that was habitual and familiar. True enough, though, as time has passed, I have gone part way in that direction, for about 12 years ago I began to buy growing timber lands in my own State with my savings; I have kept on with it, and expect to go further in that region or some other. In its management I use as good forestry as circumstances will allow; also I am satisfied with it as property.

I repeat the question: Why shouldn't the forestry profession have done this sort of thing on a far larger scale than it has, putting into effect foresighted, and at the same time, sensible and paying methods of management, such as some men without special training are actually employing? Why should not Mr. Pinchot with his great wealth have shown the country how to do this? Why should not our forest schools have turned out hundreds of men equipped and full of relish for such business? There have been ample fields for it in the country and are to-day. A very promising one, unless I am mistaken, is the naval stores producing region in and around south Georgia. Mr. Olmsted was down there years before I was. Why didn't he see it, and act, or promote action, accordingly?

Absorption in this other line is one evident reason; also, as it often seems to me, the strong slant which the profession early got from Europe. But how about this other thing, too, full confidence in our own grasp of facts, and ability to act on them after the ready methods of ordinary business?

Business—I like the term myself, for what it means by derivation and for many associations I have with actual business. I have noted this, too, that it has been handled rather freely in the report which forms the subject of consideration this evening.

Knowledge that one is willing to bank on, nerve to go ahead on the basis of that knowledge, sturdy fiber that enables a man to take the knocks that come, settle the questions that arise, and stay in his place till the enterprise is finished—that is my own conception of what business means fundamentally, and for one, if I have little of them myself, I thank God for those qualities in men that enable them to do business. In some ways it is a lot easier to regulate other people's business than to carry on your own. The former class of activity may indeed be largely necessary in our country as time passes, but I am inclined to think that it will be carried on best not by men who make a profession of it, but by those who have themselves been through the mill of business.

Now, gentlemen, circumstances not intent have led me into this, and I distinctly don't mean to be a knocker. It looks indeed as if it was up to me to bark the other way a little before closing. So thinking, I will try to do it.

I truly honor men who, with little or no personal interest, engage in labor for the common good. Considering, however, the different directions in which personal ambition may reach out, we have to be cautious in setting men apart from their fellows on this ground. Again, if general progress is to be made the pace has got to be slowed down to that of the average.

I admire, too, men who on fit occasion can fight hard and stay with it; and a fight it was sure enough 20 years ago when the National Forests were established. Lucky the country was, as it now knows, that in that emergency there were men at hand with the vision required and along with that the fighting qualities.

The present situation looks different to me. In a way our cause is won; all well disposed men (and these are the vast majority) as far as they are informed are in a broad way with us. And the Committee's report and other similar matter being put out is by way of information. I'm for it, of course, provided only that it be sound and in the right spirit.

And the positive idea I have perhaps contributed to the discussion I hope I don't value too highly. There are these other things involved which the reports points out—public ownership, the necessity the country is under not to allow too much land to be idle, responsibility attached to ownership, an obligation also lying upon the public to do its share. We have got to state, and restate, and drive home these things. I have simply called attention to a portion of the field that I thought in a fair way to be somewhat neglected.

CO-OPERATION BETWEEN THE FEDERAL GOVERNMENT AND THE STATES ¹

BY J. G. PETERS

Chief of State Co-operation, U. S. Forest Service

The progress of any forestry program will depend, in general, upon the degree of co-operation achieved on the part of the private owner, the State, and the Federal Government. Each has an obligation, and each must recognize this obligation in a practical way before a beginning can be made in the solution of the timber-supply problem. Clearly, the success of the undertaking will be dependent upon the amount of money available. If we are obliged to continue with the customary meagre supply of funds, there will be a relatively small accomplishment; if we take hold in "man-fashion" financially, we shall doubtless have something really worth while to show to the next generation for our efforts. To gain success, adequate appropriations by the Federal Government and by the States and adequate participation on the part of private forest owners is required.

By reason of its centralized authority and its ability to raise funds, the Federal Government is the natural leader in such a movement, and should, of course, give liberal financial assistance. It has already started certain enterprises. In response to the larger public demand that is bound to be made, Congress will be obliged to take adequate action. Furthermore, the interests of the Federal Government are very great. Not only must it protect and manage its own forest lands, the National Forests, but by reason of the general character of the problems of timber supply and water conservation, which affect the entire nation, it should also assist in protecting and encouraging timber production on other than public lands.

Consider this, also, with reference to Indiana, Ohio, Illinois, and the other States of the Middle West. None of these States has a timber supply adequate to meet its own timber needs. It is a matter of concern to each of them how these needs are going to be supplied; as a

¹ (Address before Tri-State Forestry Conference, Indianapolis, Ind., October 22, 1919.)

group they are vitally interested in what other States may do. They wish the Government to aid them and other States as well, in order that all the States may be assured of a sufficient quantity of timber for the future.

There are some fields in which co-operative effort between the Government and the States is almost essential if results commensurate with our needs are to be obtained. The following may be mentioned: (1) Acquisition of public forests; (2) protection against forest fires; (3) reforestation of denuded lands; (4) conservative cutting; (5) farm forestry. Besides these there are other forest activities which either the Federal Government or the States have been conducting independently, such as an investigation of the forest-tax problem, a survey of forest resources, land classification, and research. There is no question whatever about the importance of these other forest activities, but co-operative effort in carrying them forward is not essential, although in some instances it would be beneficial.

One of the chief features of any forest program must be the acquisition by the public of lands unsuited for agriculture or settlement. It is estimated that the area of such lands now in public ownership should be doubled; that is, we should strive for an ultimate area of some 300 million acres. National Forests now aggregate 155 million acres, and State Forests about four million acres, nearly three-fourths of which is held by two States, New York and Pennsylvania. Municipal-forest areas are negligible. The acquisition of lands for public forests has been a very slow process, except where such lands have been set aside from the public domain, as has been done with nearly all the National and some State Forests, notably those in the Lake States. The Federal Government has been purchasing lands for National Forest purposes since 1911, and, in this period of nearly nine years the funds appropriated have amounted to only \$11,600,000, and the area acquired totals less than two million acres. The cost per acre has averaged about \$5.25. The appropriation recommended for the current fiscal year was \$2,000,000; Congress cut it to \$600,000. The States, with the exception of New York and Pennsylvania, have done comparatively little. New York has acquired nearly two million acres for State Forest purposes, and has recently authorized an issue of bonds to the amount of \$7,500,000 to supply funds for purchasing additional areas; Pennsylvania has about one million acres; Michigan, Wisconsin, and Minnesota have between 300,000 and 400,000 each; ten

other States have forests ranging in area from 60,000 acres to less than 1,000.

As it will be necessary to purchase the bulk of the area to be acquired, the cost will amount at least to three-quarters of a billion dollars. But at the present rate of acquisition any considerable accomplishment will require a long time. Especially is this the case with the States, as has been shown. Therefore, it is desirable not only to speed up appropriations by Congress and the State legislatures, but, at the same time, to devise a method by which the Federal Government can aid the States. I am convinced that some co-operative plan is needed for encouraging the States to adopt an adequate purchasing policy. I suggest that the Government loan to the States the necessary funds subject to the approval of the National Forest Reservation Commission, which is the commission that approves the purchase of lands for National Forests. The Government should obtain the funds through the issue of bonds, and the loans should be made on a long-term basis. The National Forest Reservation Commission would make the actual purchases subject to the approval of the corresponding State commission, and the Government would be secured in the transaction by retaining title to the lands until the debt was liquidated. At the same time the States would be the custodian of the property and would protect and manage it and collect the receipts. The Government would lose nothing on such deals because it would charge the States enough to meet the interest payments on the bonds, and the States would thus get the benefit of the Government's credit and of low rates of interest. The States should not find such transactions a heavy financial burden, for the sale of forest products and the fees for grazing and other uses should furnish the money not only to pay the interest on the loans, in many cases from the very beginning, but also to build up a surplus to pay off the loans.

Before passing on to the next subject I might pause here to say that some persons, especially some of those who became alarmed at the proposal for a program of forestry on private lands, would have the public buy all the large bodies of cut-over land and would make the public the only large owner of forest lands. Entirely aside from the questions of whether, in the light of the experience of other nations, this would be good policy, and of whether our public would approve it, the plan would not be successful in meeting present needs. If what has been accomplished in the past is any indication of what may be ex-

pected in the future, it is perfectly apparent that the completion of any reasonable program of acquiring land for public uses will require many years.

While it is urgent that the Federal Government and the States should acquire public forests and take proper care of them—that is, protect them from fire, cut them conservatively, reforest them, and so on—the obligation goes much farther. They must, at the same time, recognize their responsibility to encourage the proper care of private forests, the area of which, even after the program of acquisition has been completed, will at least equal the area of public forests. The public has scarcely any greater obligation with respect to forestry than that of aiding in the protection of private forests from fire. Nor is there any forest activity in which co-operation between Government and State will bring quicker and better results. Fire protection is fundamental. It is the chief means of preserving timber growth in order that forestry may be practiced and a continuous supply of timber be maintained. Adequate fire protection will undoubtedly solve a large part of our forest problem. It will save timber now standing, and it will promote natural regeneration on most cut-over lands after lumbering.

Though in a very inadequate way financially, a beginning has already been made in co-operative fire protection by the Government and States. Enough has been accomplished to demonstrate the practical value of the co-operation, and, furthermore, a precedent for Federal and State co-operative effort in forestry has been established by the specific terms of a Federal law. This law is the well-known Weeks Act, which passed Congress in March, 1911. It provided for two things—the acquisition of lands for National Forest purposes and co-operation with the States in protection from forest fires. The latter provision was an after-thought, an experiment, the results of which have justified it as a permanent policy of the Government.

The Federal appropriation for co-operative fire protection for the current year is \$100,000. The law requires that the protection must be limited to private and State lands on the forested watersheds of navigable streams; that a State must have provided by law for a system of forest fire protection, and that the Federal expenditure in any State shall not exceed in any year the expenditure made by the State. Co-operation began in 1911 with eleven States, in which approximately seven million acres of forest land received protection; 200 Federal patrolmen were employed; and the Federal expenditure

was only about \$39,000. The number of States is now twenty-four; the area protected is approximately 15 million acres; the number of Federal patrolmen employed is 400; and the Federal expenditure is practically the full appropriation of \$100,000. The States co-operating include all but one of the Northeastern States, about half of the Southern States, the three Lake States, the four in the Pacific Northwest, and California. The chief value of this co-operation, in addition to a certain amount of protection afforded, has been educational, since States that have had no protective system have been encouraged to enact legislation providing for such a system and appropriating funds for its support. Furthermore, private owners have been encouraged through State and Federal co-operation to adopt protective measures, and, where practicable, to organize into associations.

The Federal appropriation is allotted to the States on the basis of the greatest good to the greatest number. A maximum is fixed, depending on the number of States to receive co-operation. At first this was \$10,000, but the increase in the number of States necessitated a reduction first to \$8,000 and then to \$7,000. The money is used primarily for the hire of lookout watchmen and patrolmen. The watchmen are stationed on prominent points from which the lower country may be seen and forest fires readily detected. By means of the telephone, these men describe the location of a fire to patrolmen or fire wardens, who endeavor to secure help if necessary and to reach the fire as quickly as possible.

As compared with the Federal expenditure of \$100,000 annually, the twenty-four States co-operating are expending about \$650,000, and private owners in these States approximately the same amount. In these twenty-four States the private and State holdings that require protection from fire, including both timbered and cut-over lands, aggregate at least 140 million acres. Adequately to protect this area will require yearly a minimum expenditure of $1\frac{1}{2}$ cents an acre, or somewhat more than \$2,000,000. If, as stated above, these States and the private owners are together expending about a million and a quarter dollars, this sum falls short of the estimated minimum by about three-quarters of a million. From these figures it is obvious that the Federal Government is not fully recognizing its responsibility in this matter. Furthermore, this list of twenty-four does not include such important timber States as Pennsylvania, Tennessee, South Carolina, Georgia, Florida, Alabama, Mississippi, and Arkansas. If co-operation were extended

to these, the above-mentioned area of 140 million acres would be increased at least to 200 million, for the adequate protection of which the minimum expenditure required would amount to \$3,000,000 yearly. My opinion is, therefore, that when the States and private owners do their part, the fair share of the Government in the co-operation would be at least \$1,000,000.

Before leaving the subject of co-operative fire protection as provided for under the Weeks Law, I wish to say that it is my belief that the best interests of the public would be served by doing away with the limitation in that law in regard to the watersheds of navigable streams and by placing the co-operation exclusively on the basis of protecting our future timber supplies. The fact that the purchase of lands is limited to such watersheds is no sound reason for so limiting the co-operative fire protection. An unnecessary restriction is placed on the expenditure of Federal funds on certain lands where protection is urgently needed. As a matter of fact, all forest lands need protection from fire; therefore, this restriction should be removed.

I have in this paper given the subject of fire protection more space than other subjects; and, although I realize that it is of minor importance in parts of Ohio, Indiana, and Illinois, still it is the largest forest problem that confronts the country as a whole, and I understand how very seriously it affects the wood-using industries in those States which draw their supplies of lumber and other forest products largely from other States. Moreover, fire protection is the only co-operative undertaking in forestry that the Government and the States have started on a substantial and permanent basis.

Along with fire protection should go the reforestation of denuded lands. The aggregate denuded areas not acquired by the Government or the States will be large. On account of the present economic conditions, as well as the time required, these areas will remain unfor-ested for a long period unless the Government and the States co-operate with the private owners. Some of the States have been doing this for a number of years. The common practice is for the State to sell the planting stock at cost to the owner of the land. But even when this has been done, the accomplishment in the reforestation of private lands has been almost insignificant, both because of the small appropriations made by the States for the purpose and because of the cost of placing the young trees in the ground—a work which of necessity is done largely by inexperienced laborers. The present average cost of

such planting is about \$10 an acre, including the price of the trees, which generally amounts to less than half. If we consider first only the most important stretches of denuded lands, it is estimated that the area totals at least five million acres. The cost of reforesting this would amount to approximately \$50,000,000; or, if 100,000 acres could be reforested annually, the yearly cost would be \$1,000,000. Even so small a program of reforestation would require 50 years. If private owners would enter into contracts with the States by which the owners would pay the cost of the planting, which would be at least one-half the total, and agree to give the plantation the necessary protection and care, I believe the Federal Government would be justified in encouraging the undertaking by sharing with the States the remainder on a 50-50 basis, or, to be specific, by making a yearly appropriation of \$250,000.

Some day we shall have in this country a sustained yield of timber year after year. Some day we shall manage our forests with this in view. A few organizations, like the larger pulp companies, are endeavoring now to place their business on a sustained-yield basis. But in many cases this is scarcely possible on account of the pressure for quick returns and the prevailing method of financing forest lands. The Federal Government and the States should co-operate as far as possible in encouraging and aiding private owners to cut their forests conservatively. The way that appears now to be the most feasible is through some form of loan that will enable timberland owners to secure money from the Government or the States on easier terms than is possible elsewhere, and through a change in the method of taxing forest land. It has been suggested that the provisions of the Farm Loan Act be extended to include the financing of forest properties, and that Federal Forest Loan Banks be established. By whatever plans of finance and taxation the conservative handling of our forests is made possible, the Government and States might co-operate further and follow the custom that prevails in some foreign countries of detailing foresters to the owners of the large, so-called commercial timber tracts to assist in the work.

The conservative handling of forests connected with the farms may be very largely encouraged through the agricultural extension work conducted under the Smith-Lever Law. The appropriation under this law for the current year is over \$4,500,000, which, for the most part, the States must duplicate. The money is allotted to the States on the

basis of rural population and is expended through the States Relations Service in co-operation with the Directors of Extension in the various States. The work is chiefly demonstrational and is conducted by County Agents right on the ground. One can readily see the possibilities here for extension work in farm forestry. It offers practically a virgin field. No phase of forestry is of greater importance to the States of Ohio, Indiana, and Illinois than the proper handling of farm woodlands on the basis of continuous production. The area of farm woodlands in these States is about 10 million acres, which is approximately 90 per cent of their aggregate forest area, and farm woodlands occupy between 10 and 15 per cent of the area in farms.

As in agriculture, so in forestry, the most effective way to encourage farmers to adopt scientific practice is through field demonstrations on their own property or in their own locality. Of course, any increase in the value of products is an additional incentive. Farmers have given little or no attention to the proper handling of their woodlands, and they have been strikingly ignorant of the value of wood products. As a rule, they are chiefly interested in getting immediate returns from the woodland and care little about its future development. This fact should serve as a method of approach in encouraging them to cut their timber conservatively. In other words, they must be assisted to get larger revenue if they are to become more interested in improving the woodland and raising more and better timber. To this end farmers need to be given practical information about markets for the various kinds of timber, methods of selling, the variation in the common log rules used, and, where practicable, the grading of lumber. In some cases it may also be feasible for the farmers to form co-operative associations for marketing timber, as they have formed associations for marketing other agricultural products. An association of this kind would be able to market the material to better advantage than the individual owners would be able to do.

Farm forestry should be an important branch of farm management, particularly in connection with diversified farming of the kind practiced in Indiana, Ohio, and Illinois. It offers an opportunity to use land that would otherwise be idle. The forest on the farm is the source of much wood for such home uses as for fuel, fence materials, and rough building stock. Where coal is largely used the farm woodland affords a reserve fuel supply. The woodland serves for windbreak for crops; it affords shade for stock; it offers an opportunity for the

profitable employment of men and teams at times when other farm work is light; it helps to check erosion; and it brings in revenue from the sale of wood products. Surely in this region the most should be made of the farm woodland.

Farm forestry is recognized by the States Relations Service as coming within the scope of the extension work authorized by the Smith-Lever Law. But before farm forestry can be conducted on an adequate scale the Forest Service must have additional funds in order that trained foresters may be employed to direct the work. The States would then be authorized to use Smith-Lever funds in employing foresters to do extension work in the various counties. These foresters would conduct demonstrations, give practical information to the farmers, and instruct the County Agents in forestry practices. In the States of Indiana, Ohio, and Illinois it is urgent that co-operative work of this character should be started and carried on aggressively.

I have endeavored in this paper briefly to describe the main features of co-operation which the Federal Government and the States should undertake, or which, if already begun, they should largely extend. The question is chiefly one of making funds available. This is for the public through Congress and the State legislatures to decide.

PLAN OF RELATION OF FOREST REGULATION TO FOREST COMMUNITIES

BY M. H. WOLFF,

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The Coeur d'Alene National Forest in Northern Idaho is, in common with most National Forests, mountainous and unquestionably absolute forest land. The boundaries of the forest make it roughly an isoscles triangular in shape, with a base running east and west, and the apex pointing almost due north. Along the western leg is a chain of three lakes, one of them quite large, which lie approximately at the foot of the heights marking the boundary, and a few miles to the west of it. The eastern leg is the summit of a high and rough divide, which is part of the boundary between the States of Montana and Idaho. The base is practically bounded by the Coeur d'Alene River and its South Fork.

With its mouth at about the center of the base is the North Fork of the Coeur d'Alene River, which, with its headwaters at the north end of the forest, flows southeasterly, roughly paralleling the eastern boundary of the forest until about the median point of that boundary, from which it flows in a general southwesterly direction toward its mouth. It has numerous tributaries, of which the principal one, practically as long and flowing approximately in the same direction as the first part of the North Fork itself, is the Little North Fork River.

Along the western boundary is a rather heavily settled region where the principal industries are farming and lumbering. Just to the west is the fertile region around the important city of Spokane, in the State of Washington. The mountains of the forest form part of the eastern limits of this agricultural region. Close to the forest between the lakes and the boundary is a relatively dense agricultural population, slowly developing cut-over lands into farms.

A large timber growing territory is tributary to Coeur d'Alene Lake, by virtue of its feeders—the Coeur d'Alene and St. Joe Rivers. At present on that lake are sawmills capable of cutting 250,000 to 350,000 thousand feet of lumber annually. Originally, the timber was close at

hand, but what remains available is becoming more and more inaccessible.

Along the Coeur d'Alene River proper the principal industry is farming, with lumbering a close second. Along the South Fork mining is by far the dominating activity. It is here that the famous silver-lead mines of Northern Idaho are located.

Along the North Fork are numerous settlers bunched here and there, who in the past have been engaged principally in lumbering, but who are now gradually more and more active in farming lines, though lumbering is still one of their principal activities during certain seasons of the year.

Roughly, the Coeur d'Alene Forest contains about 800,000 acres, of which approximately 130,000 acres are alienated and about 85,000 acres covered with burns not reproducing, or other non-productive land, or with protective forest. The 585,000 acres of productive forest land have a fairly equal distribution of age classes. Such big gaps as do occur are about equally distributed over the forest, and in view of the character of the timber stands can be readily taken care of.

Both the North Fork and the Little North Fork Rivers, on which the principal bodies of timber lie, are readily drivable. Many of their principal tributaries are also of such character and so located that from this point of view the forest is relatively very accessible. Development for mining purposes has resulted in the construction of railroads paralleling the southern side of the forest, and also up the North Fork of the Coeur d'Alene River for a distance of about one-third of its drivable length. Either trails or roads make it possible, within reasonably economical costs, to reach any portion of the forest, and these are being gradually extended.

The principal timber species on the Coeur d'Alene Forest is Western white pine, for which normally there is practically an unlimited demand.

There are at hand, therefore, the various elements making up the factors to be considered for a workable plan for regulation: a useable product in demand, accessible to market; an industry developed for handling the raw material; and manufactories for producing the finished product out of this raw material. But most important of all, these circumstances brought about the condition that the demand for cutting and for the timber itself was so closely approaching the roughly estimated sustained yield of the unit that it became immediately necessary to build up a working and cutting plan, at least a preliminary one

The various features of this working plan are in common with most working plans. The basis of regulation, however, is, as far as is known, peculiar to the Coeur d'Alene Forest.

One of the biggest and first factors to be considered in making up a plan of regulation is the division of the unit under consideration into working circles. The whole unit may be thrown into one working circle, or, depending on conditions, the divisions may be made more and more intensive.

On the Coeur d'Alene Forest the lay of the land makes possible three courses. The forest could be considered as part of a region-wide circle, could be thrown into a forest-wide working circle, or several working circles could be defined within the forest itself.

The region-wide circle would include the Coeur d'Alene Forest and a number of neighboring forests which lie in the white pine region and in a general territory from which lumber is one of the principal heavy exports.

The forest-wide working circle is the scheme customarily used on National Forests, because of its simplicity and the lack of need for any more intensive regulation.

The third scheme contemplates division of the forest by main drainages into logical units.

The advantages of the first plan would include the probability of highest revenues immediately from National Forest lands, since in the whole region it would be possible to encourage and promote cutting activities in the most accessible portions, leaving the inaccessible portions to make up the later cuts. There would also possibly result the delivery of lumber to the consumer at a cheaper cost, though not necessarily at a cheaper price to him. The difficulties and disadvantages are that there would be involved inter-administration between forests and also a lack of permanency of local industries, logging, milling, and others dependent on them.

The inter-administration between forests would not be a very difficult matter to adjust. The lack of permanency for industries would, as is well known, result in great economic losses involved in the building up of establishments and the removal from one vicinity to another as the timber gave out. This, in most places in the past, has not resulted so seriously, but that was because cutting out of timber has been followed as a rule by the development of agriculture, though sometimes very slowly. In a mountainous country, practically all absolute

forest land, agriculture is so restricted by topographic and climatic conditions that even what little beginnings have been made would not be continued were there not the additional assistance of the lumber industry to support them.

The second scheme has similar advantages and disadvantages as the first scheme, but to a less degree.

The third scheme, being the most intensive, very definitely brings to light positive objections and positive advantages.

The disadvantages of this scheme are: First, the intensification of administration. This is not a serious objection. Second, there is advanced the desirability of handling mature timber in accessible locations as quickly as possible, because of the fire danger. With the planned and hoped-for development of fire protective work, no great consideration need be given this factor, else all intensive forestry work had better be abandoned.

A third objection often advanced is that, on National Forests particularly, there is a great amount of mature and over-mature timber—a surplus stocking which should be removed as rapidly as possible—and if working circles are made too small, the existing distribution of age classes may seriously conflict with the accomplishment of this object. This is a disadvantage which must be weighed, where it is of any great importance, against advantages which exist. That it is not an objection in the case of the Coeur d'Alene Forest has already been mentioned.

A fourth disadvantage is that relatively more inaccessible timber on the average would have to be put on the market than would be the case under a scheme of larger working circles, in which the cut could be concentrated in the more accessible timber, with the result that, broadly considered, true economy is not practiced, and specifically, receipts are less than they otherwise would be. It is felt, however, that this is not a serious objection. True economy must consider greatest benefits in the long run. As to receipts, if decreased they are only temporarily decreased. Whatever timber is relatively more accessible at this time will be relatively more accessible at a later time, and as values increase both the relatively accessible and the relatively inaccessible bodies of timber will increase in value.

The advantages of this intensive scheme of working circles, where it is possible practically to work them, are many. In the first place, if there is a healthy start in this direction and possibilities for growth, the establishment and maintenance of permanent industrial communities is

stimulated. Thus, there is less loss to the commonwealth due to the waste of effort and material involved in a nomadic industry.

Incidental to this first advantage is that a better class of laborers is developed. In the lumber industry particularly this is a very important factor. A permanent community, where a man can make his home and be assured of work in the vicinity, will bring about not only greater contentment, and thus efficiency on his part, but also greater loyalty to his country and his employers—in other words, will make him a better citizen.

Another feature incidental to the maintenance of a permanent industry is that various kinds of logging improvement structures are maintained by the stability of their use. Better and more expensive improvements are justified and more economic handling of raw material results.

With a more intensive division of the working circles, there is possible a wider distribution of the cuttings. As a result, there is better chance for the control of any insect menace, or for the handling of any incidental fire loss.

The division into small working circles, resulting in the development of permanent logging improvements in several localities, makes available for sale both small and large units, which is one of the desirable features of governmental control, without incurring the usual disadvantages of less economical handling of the small operation.

The more general disposition of communities and operations over a unit as a result of the more intensive scheme, makes available, distributed over the unit, a personally interested fire protective force supplementing the regular permanent force for that work.

Finally, the scheme of more intensive division of working circles is the safe, conservative course. If later found desirable, it could easily be abandoned in favor of either of the alternative policies, while the reverse would not likely be readily possible.

Thus, it will be seen that the choice of any one of the three policies in laying out working circles is a question of degree. The smaller the working circles, the more intensive consideration can be given to the numerous factors which must be weighed.

The choice of the plan to follow, that is, the basis of the number, size, boundaries, etc., of working circles, is dependent essentially on the object of management. A few elementary considerations must be brought to mind at this point in deciding the course.

For regulation, one of the latest authentic definitions is the fixation in advance of the annual or periodic cut which in the normal forest would be equivalent to the annual growth. It might be stated that forest regulation has for its chief object the provision for so managing rotation of cuttings on any given forest area that equivalent yields of harvestable timber can periodically, by periods of one year or longer, be obtained. Other objects of management, such as watershed protection and the stability of esthetic values, are usually secondary and follow naturally from attention given to the first. Yields of harvestable timber are figured to be equivalent by periods usually as to volume, and to a less extent as to the species and quality of crop.

The division of its area into proper units, that is, working circles, is the first step in establishing figures for regulation on any forest. The conception of working circles here used is that smallest unit area within which equivalent yields will be periodically made available. The number, size, and boundaries of the working circles are dependent on the object of regulation. On National Forests the object is unquestionably that of sustained equivalent yields from the standpoint of volume.

Sustained yield has of itself, however, a definite purpose—continuity of supply or stability of delivery of timber material and regularity as to the amount of such delivery. Delivery of timber material, it is conceived, can be made stable and constant, for either (*a*) the ultimate consumer, or (*b*) as raw material for the intermediate producers. Under (*a*) there is to be considered the general market consumer; that is, the State, region, or the country, or even the world market; or secondly, the local market consumer, settlers, or nearby communities. Under (*b*) there is to be considered delivery for established or operating mills dependent on this source for their raw materials; and, secondly, for established and operating logging communities, that is, small communities, if any such exist, dependent entirely on the logging industry for their stability.

The responsibility of the Forest Service in handling timber on a sustained yield basis in accordance with the policy it must decide upon lies in the choice of which one of these classes it is best to serve, that is, what course would yield the greatest good to the largest number in the long run. This question is further complicated by immediately insistent factors of ever-clashing practicality, such as accessibility to markets. With these last well considered, compromises must be made,

since too much cannot be sacrificed for the ideal of regulation, itself necessarily based on none too accurate forecasts, though the best available under present standards.

To accomplish the first object, the maintenance of delivery to the general market consumer, a regional working circle is satisfactory. In the white pine region of the Inland Empire, whence close to 100 per cent of the timber produced goes to the general market consumer, there would be included the whole region.

To accomplish the second object, maintenance of product for the local market consumer, it would be necessary to fix an area tributary to the community having about the proper amount of yield which it is foreseen the community would need. This is a consideration at present not of serious import on the Coeur d'Alene Forest, as far as the principal species now being cut (white pine) is concerned, though it will unquestionably later develop as needing consideration with respect to species at present of minor importance which form the supply of mining timbers for the local mining industry.

For the third object, the first case under (*b*), a working circle would include only those areas reasonably tributary and accessible to the mill or group of mills. The capacity of the mill or mills might conversely be made to depend on the yield of a selected logical working circle unit. In the case of the Coeur d'Alene Forest, sustained production for mills dependent on forest timber would involve the inclusion of two or three neighboring forests in the working circle.

For the fourth object, the last alternative under (*b*), considerations similar to those for the second object would govern, except that usually the working circle would have to be smaller in area. The factors to be considered in determining the sizes, boundaries, etc., would be the accessibility for transportation of material and labor from the community centers to the scene of work.

Hitherto in establishing working circles on National Forests a forest-wide working circle has been a standard, the principal reasons for this being to provide for continuous lumber manufacture in each locality and the simplicity of handling the problem administratively. Roughly there was kept in mind, also, the maintenance of supplies of material for the general market and for any established mills in the territory.

On the Coeur d'Alene Forest it was determined to plan the working circles so as to develop and maintain local logging communities. This

is an ideal scheme to be followed wherever possible. By its application all other demands of regulation are subserved. The continuity of established sawmills will be as well assured as with larger working circles, and the ultimate consumer will likewise be protected.

The small circle scheme will stimulate local logging communities. Permanent work in one locality will give men a chance to satisfy a natural desire for settling down. Small communities not only carrying on logging but incidentally supporting people who serve the needs of the woods workers will start, thrive, and continue, as has already happened in many localities. In the Coeur d'Alene region, because of the drifting labor, the maintenance of logging communities is very important. The immediate effect on labor by the war emphasized this; the problem was a very difficult one even before the war, however, and will undoubtedly continue for some time.

The idea of developing community, and ultimately through it, family life for woods workers is not at all a new one. But it is thought that the Coeur d'Alene National Forest working plan is the first one that actually endeavors to provide for it as far as it may be influenced by the bases of the regulation of cut. One of the chief risks in the logging industry would be obviated if the woods worker would change into a settler instead of a nomad.

The big factor, however, is the fact that several communities are already established of which the greatest percentage of the population is dependent on the logging industry. The city of Coeur d'Alene, with a population of about 7,000, lying just outside the forest, at about the middle point of the western boundary, established originally on the strength of the logging industry, has been slowly retrograding as nearby timber tracts have been cut out, but still has a large population which finds its work in the National Forest adjacent. Similarly situated are smaller communities and groups of permanent settlers for whom the logging industry is the principal bread-winning activity, and in several localities the owners of the partly developed stump farms eke out their incomes by work in the woods at certain seasons.

The policy decided, the first step in figuring out the working circles on the Coeur d'Alene Forest was to determine approximately where, as influenced by topography and transportation, existing logging communities would be maintained or others possibly established in the future.

With a rather intensive development of the idea in mind, the forest divides itself naturally into six working circles. These are (a) the ter-

ritory directly tributary to the lakes on the west side of the forest; (*b*) the Little North Fork River drainage; (*c*) the drainage of the main Coeur d'Alene River and its south fork; (*d*) the upper waters of the North Fork River; (*e*) the middle portion of the North Fork River and its tributaries; and (*f*) the lower North Fork and its tributaries. In four of these, (*a*), (*c*), (*e*), and (*f*), communities dependent upon logging, to greater or less extent, are already established. In a fifth, (*b*), it is quite certain that the construction of one road recently carried out, and its further improvement and extension will gradually cause the start of another local community. The sixth working circle, most inaccessible from the standpoint of labor and supplies, very evidently cannot be successfully handled even with respect to any part of it until transportation development is such that the rude farms being established there definitely begin to make unmistakable strides toward permanent development. Such transportation development is foreseen in the by no means distant future.

In three of the automatically formed working circles (*a*), (*c*), and (*d*), very little, if any, logging is carried on. This is either because the species in the composition of most of the stands make them not readily marketable, or because they are relatively inaccessible. Those of the residents here who find livelihood in woods work, either all or part of their time, carry on this work, though with some inconvenience on account of poor transportation, in one of the other three working circles adjacent. And in each of the other three working circles are found the stands which in character and composition are most desired by timber-buying concerns.

This condition, however, it is emphasized, does not make negative the desirability of having six working circles. Because of pioneer conditions of transportation and development of homes, most of the labor in the woods is of the nomadic type, and the ideal kind of labor, permanent in the locality, cannot be stimulated without permanency of the industry in that locality and permanency of industry is predicated on small working circles.

Because of the conditions in establishing immediate regulation of cut, the six natural working circles are paired, (*a*) with (*b*), (*c*) with (*f*), and (*d*) with (*e*). Each two combined into the working circle thus formed are considered as blocks in their respective working circles. The regulation of cut in each circle is on the basis of the productive capacity of the whole.

This is a sort of compromise between the ideal and that which is most practical, which from the point of view of maximum, immediate receipts would have been a forest or a region-wide working circle, judging from the demands in the form of applications for definite bodies of timber. This compromise from the ideal is felt justified for several reasons, more or less interdependent.

A market is developed and in general a demand at the present period exists for even more than the total annual estimated yield (the authorized cut) for the forest. To restrict too much the cutting in the marketable stands, as would happen if the three most desirable natural units were cut only to the extent of the estimated yield in them, would result in suddenly suspending from use about half the supply of timber now being utilized from the forest. The demand for the material has been fostered by the Forest Service in the past, and there are therefore certain definite moral obligations to respect.

This over-cutting in three of the natural working circles is in all probability more apparent than real, because, first, the estimates of growth are very conservative, and, secondly, with the natural development of the region more and more cutting will gradually take place in the blocks at present not marketable, so that there will follow just the same the tendency for the cut to be distributed evenly.

On this last basis also the three-circle scheme need be considered only temporary. The development of markets and transportation will cause extension of cuttings and their distribution more evenly throughout the six natural blocks. This will happen within a sufficiently short time so that, considering the conservatism of the estimates, no great discrepancies in age stands will result and a return to the six-circle idea will still be possible with but little difficulty, if then desired. On the other hand, the country is in the pioneer stage and real development has just begun. The development of transportation which would increase the radius of activity from one point in the next decade or two may be such that the three-circle scheme will, even with only a permanent logging community ideal still paramount, be most logical and finally be definitely established.

Thus the three-circle compromise is the conservative middle ground involving no radical changes in present selling policies, but safeguarding and controlling cutting so that the regulation scheme remains amenable within reasonable limits to any changes found necessary in the future.

The result of the whole idea is that there is indicated to the administrative officers what localities need now to be specially concentrated on to develop sales, and where the making of sales is to be somewhat controlled. The distribution of the established cut between the two blocks of each working circle is favored where other considerations permit. A distribution of cutting over the forest is being gradually approached, yet without conflicting with or disrupting appreciably the normal practical demands, and at the same time meeting as before the requirements for a continuous supply for mills and for general and local consumers.

The foregoing discussions cover some of the principles on which regulation on the Coeur d'Alene National Forest is based. As a matter of possible interest there are supplementarily presented some aspects of the more detailed portions of the preliminary regulation figures. The development of the forest silvicultural working plan, in which a number of peculiar and interesting features will have to be considered, is still to be carried on. At a later date there will be presented a more detailed discussion of the work so far done and that still to be accomplished.

The regulation figures themselves are necessarily rough, but are considered quite sufficient for preliminary data. The basic data are partially the result of extensive timber survey work. Some of the intensive survey work also, accomplished in the early development of reconnaissance, could have been better. Generally, the blocks now accessible and being appreciably exploited are covered by the intensive work.

A tabulation showing such basic data as is available as to distribution of age classes, follows: There is also given a separate table showing what timber estimates are available.

Besides these data, from which all yield and increment figures were obtained, reference was made to more intensively prepared yield tables for the purpose of checking as to rotation age and yield. For the purpose of the preliminary plan, however, the empirical results obtained were used.

Timber holdings on alienated lands in and near the forest also add a variable to the rate of possible delivery of materials to local operating communities. There are no probable regularities as to the rate of cutting of these that can be figured on, and, furthermore, at least under present conditions, no control over these could be exerted properly to distribute the cutting according to the Government's ideals. The influence of alienated timber bodies on the forest communities has there-

fore been disregarded. Similarly the influence of such catastrophic yield reducers as large fires has been disregarded, since their effect is also indeterminate, and since development of protection will, with occasional exceptions, make the effects of these generally negligible. These two factors are so indefinite in their bearings that for preliminary information as to regulation figures, which is all that can be hoped for at present, they need not be weighed. The fact that the basic data itself is to a marked extent extensive has greater weight, and in spite of this the conclusions are valuable. As a safeguard against serious blunders all figures have been kept conservative.

All these factors will be of indeterminate influence only for a few years at a time, since the working plan data will have to be worked over again every five or ten years as additional intensively obtained information becomes available, and as development, both in changes in timber stands themselves, and more especially of local economic conditions becomes more definitely observable.

The estimated annual yield figures on which regulation on the forest is based, are, for the total fifty-four million feet, board measure, distributed in the Lakes Working Circle, seventeen million; the River Working Circle, twenty million; and the North Fork Working Circle, seventeen million. It is not intended that the annual cut in each circle should adhere closely to this indicated cut. Because: (1) Logging itself on each working circle is still nowhere near settled, as to annual extent, and greater or less cuts temporarily maintained would for the present have little influence on community development. (2) Logging improvements for regular and efficient work are still to be in most places made and occasionally special large bodies of timber may have to be marketed to obtain these. (3) Seasonal variations may cause delays or other modifications of logging plans. (3) There already exists a small local surplus aside from the general surplus in stock, saved up within the last few years because of failure to utilize even to the above limitations, so that the usual sustained yield would, broadly, not be affected.

It is proposed that for the present at least, these figures can be varied up or down as much as 20 per cent in any one year, either by working circles or less preferably by the forest as a whole, but with the restriction that in any twenty-year period the average annual cuts by working circles will be approximately these figures. The ideal, of course, would be to approach the actual annual cuts as indicated just as nearly as possible.

These amounts represent actually the figured yield on the white pine type alone in only the accessible blocks of each of the working circles, obtained by a modified application of the Austrian formula, figuring the removal of the surplus to be distributed over thirty years, a liberal period, at the end of which time the less merchantable types and blocks will be economically accessible.

THE CUT - OVER LAND PROBLEM ¹

BY D. P. TIERNEY

One of the promising things in every forest region where the use of cut-over lands is a problem is the large acreage of well-stocked young forest. This is particularly impressive in the Lake States, the South, and East. The control and management of these areas, to my mind, offers the very best opportunity for starting a progressive forest policy. It is obvious that quick returns will be obtained from these areas, and that with a minimum outlay of money. There is no need to wait for land classification nor for laws and regulations that will bring about conservative logging; and artificial restocking of once forested areas will be encouraged and undertaken in time on a large enough scale to keep pace with cutting.

There are many millions of acres of thrifty young coniferous and hardwood forest that only require protection and care. The owners give none, because they consider such stands of no value. Often the land itself is regarded as of little value. There are no means at present adequately to protect the economic welfare of the State by safeguarding this class of forest growth from indiscriminate cutting and waste. Effective measures of fire protection even cannot be applied. There is just the hope that it will escape destruction and continue to grow. If public sentiment will favor any measure looking to future timber production, certainly a course of action not involving wholesale purchase of so-called devastated lands, with expensive planting operations at a heavy initial cost, but one which gives the desired results at a low expenditure should be acceptable.

To illustrate this situation: There is now a great deal of interest in the pulpwood supply. Some efforts are being made by operators to provide for the future by planting and by selective cutting. Throughout the pulpwood districts of the Lake States, Canada, and the Eastern States, there are great non-agricultural areas in swamps bearing small spruce that under existing conditions grows very slowly. By controlling drainage, the rate of growth can be so accelerated as to make these areas very productive. Here, then, is a potential resource of

¹ Read before the Saint Paul Section of the Society, March 8, 1920.

enormous value, if appropriate measures of forest management are applied. The growth of ten to fifty years is there; the land is low priced; and a comparatively inexpensive system of drainage (lowering the water level) will in the majority of cases increase the growth by several hundred per cent.

There is one big handicap to sustained management of forests—Federal as well as State—and that is the dependence for maintenance on annual or biennial legislative appropriations. This usually becomes a factor only when forests are under intensive management. Funds for planting, fire protection or improvement may be provided from time to time for a period of years, and then, through failure to continue funds, all prior expenditures may be lost by enforced abandonment of projects or by fire. The money necessary to carry a forest unit or several of them to the end of a rotation, or for a period of fifty to seventy-five years, can be determined with reasonable accuracy, and yet each year or each biennium the same question comes before the legislative body, with the same figures of area, growth, costs, etc. Different bodies of men in the legislature have to be convinced time and again during the crop rotation of the wisdom of the plans. So it goes in each State and in Congress. Nothing is settled for more than one or two years ahead. A study of this phase of the question in the light of the experience of various Federal and State administrative bureaus would show some distressingly big figures on waste.

The expense of maintaining forest units should be met out of a continuing tax levy, so that the legislative body would need to act only *once* in authorizing the levy. Subsequently the legislature would only need to check up on the expenditures. Foresters would do well to work for the elimination of this handicap to stable forest management.

The course of action to bring suitable areas of young growth under management would involve legislation (1) authorizing the selection and designation of these areas, (2) assigning land to a separate tax list for taxation under a prescribed method, and (3) providing the financial plan.

There should be some limitation on the total acreage to be designated and an approximate ratio of hardwood to coniferous acreage. The minimum unit should be low, so that areas as small as ten acres might come into the plan.

The method of taxing the land yearly on a nominal valuation and placing a yield tax on timber when cut should be applied. The owner

would retain his equity in the land as long as he paid the taxes, but failing so to do for a prescribed period his equity would lapse to the State. Also, if he should want some or all of the land for other than forest use, the payment of the back taxes accrued—as for other lands outside forest selections—and expense for forest work would be required.

The financial plan is the vital part of the whole idea, for fire protection, improvement work, and management cannot go on without adequate funds constantly provided. When the selections constituting a unit for management are approved, the young forest should be evaluated, and on this basis the cost by periods of bringing the stand to maturity determined. This cost would be met by the issuance periodically of bonds, the amount of which would be equivalent to the anticipated cost and with a safe margin under expectation value. Maturity of the bonds should coincide with the end of the rotations on the unit. Interest on the bonds should be paid out of an annual tax levy for that purpose. The crop receipts would retire the bonds, and the balance be paid over to the owner of the land, or to the State in case the lands belonged to the State.

Up to this point the matter is one for the State to handle, but there should be a measure of Federal co-operation, not only to hasten action by the States, but in order to produce the greatest national economy. This would be accomplished through national legislation, putting the Government squarely behind such investments (bonds) in forestry as I have described.

State forest bonds, issued against forest property that is managed in accordance with approved plans, should be given such status as would make them readily marketable. The authority of the Federal Land Banks might be extended to cover such investments.

I believe first in making the best of what we have that is best, before going to the legislature or Congress with a request for big appropriations to purchase non-agricultural lands in all stages of devastation. The acquisition appropriations must be followed by still greater ones for forest replacement, and results are an indefinitely long time in the future. The forest program should provide for building up forests out of the young forests we now have. Outright purchase of lands should be restricted to watershed protection areas and to such tracts as are closely associated with public lands now under some kind of forest management. Advocacy of a policy of land purchase, as the outstand-

ing method of obtaining land for the practice of forestry, will hinder its development by reason of the enormous expenditures involved, and by causing owners to refrain from any forestry undertaking which would mean more or less of an investment to them.

A forest policy or system of management will succeed only to the extent that the rank and file of the people will agree to it. Consequently the sympathetic efforts of the individual must be enlisted from the first. An autocratic government can ignore him and work from the national viewpoint, but while quicker action may be obtained there is no reason to anticipate better results than from a democratic method of handling the problem. With the Government acting in the capacity of bondsmen for the State forests, it would be in a position to bring the practice of forestry to the highest level of success. In exercising such functions, it would be free of countless administrative troubles, employing only a comparatively few men of high technical ability. It would hold forest policies in line when changes in state administrative forces might threaten to upset painstaking and successful work of years. On the other hand, the administrative force of the State would be in close touch with the people, closer to the problems, and readily responsive to the current of thought on forestry matters.

SOME SILVICULTURAL PROBLEMS IN PENNSYLVANIA

By J. S. ILLICK

Silviculture has been practiced in Pennsylvania for almost 250 years. In 1681 William Penn in his Charter of Rights prescribed a method of handling forest properties. The treatment which the founder of the Commonwealth prescribed never has been applied extensively, but a rough form of silviculture has been practiced by some private owners of forest properties ever since this early provincial recommendation, that is, long before any forest school opened its doors or any professional forester "hung out his shingle." Many of the early settlers who came to Pennsylvania emigrated from countries where forestry was being practiced rather intensively, and insofar as it was economically possible, they applied the simple methods and fundamental principles of silviculture to their new and cherished holdings.

It may appear academic, but it is my purpose to discuss briefly the meaning and scope of silviculture; and rather than impose upon you my definition, a number now extensively used will be considered. Fernow¹ writes that forest crop production or silviculture, in its widest sense, may be called applied dendrology. He also writes that silviculture considers primarily methods, that is, the technique of producing the crop and influencing its progress, and that silviculture is the art and operation of securing reproduction and wood crops. Toumey² defines silviculture as a branch of forestry that deals with the establishment, development, and reproduction of forests. He also says that it is an art which depends for its intelligent practice upon the principles of silvics. Schenck³ writes that silviculture comprises all human activities by which trees, wood, bark, and any other forest product imaginable are raised and tended. Zon⁴ writes that silviculture is the application of the knowledge of the requirements of different kinds of trees to the perpetuation of the existing forests, or to raising new ones and working them to the best advantage of the forest owner. In the

¹ Fernow, B. E.: *Economics of Forestry*, pages 101, 104.

JOURNAL OF FORESTRY, Vol XVII, No. 7, page 882.

² Toumey, J. W.: *Seeding and Planting*, page 3.

³ Schenck, C. A.: *American Silviculture*, page 11.

⁴ Zon, Raphael: *Canadian Forestry Journal*, Vol. XII, No. 8, page 686.

report of the Committee of Forest Terminology of the Society of American Foresters ⁵ silviculture is defined as the art of producing and tending a forest, or as the application of the knowledge of silvics in the treatment of a forest.

These definitions seem to lead to the conclusion that silviculture is an art, which functions primarily in operations, methods, systems, practices, and techniques; and only by their proper development and rational application may we hope to make and maintain productive, sanitary, and attractive forest stands.

Silviculture in Pennsylvania, in spite of its great age, still appears juvenile and weak. Just as the white pine under the oppression of scrub oak, aspen, and fire cherry, struggles for an existence or waits for a chance to grow, so silviculture has been waiting for the time when economic conditions and public sentiment would favor its normal development. This time appears to be at hand in Pennsylvania, and if nourished and handled properly and given a full chance to develop, it will soon become a strong, practical, and effective branch of forestry. But in order to accomplish this, it will be necessary to change its food. We have been trying to bring it up largely on an imported diet, and it has not been thriving. First we tried to *adopt* the methods and techniques used in foreign countries, then an attempt was made to *adapt* them, and now that both have been found wanting, we have been compelled to strike out anew and begin the development of original studies which will aid in the formulation of practical and economical procedures.

The urgent need of silviculture to-day is more and better information about the fundamentals of tree growth and the essentials of forest crop production. Better information implies close and continuous observations and original studies in the *locality* where the unsolved problems are at hand. Good silviculture recognizes the boundaries of no State or country, and does not place an undue value upon the opinion of any forester, however eminent he may be. The best silvicultural methods are often developed and used by practicing foresters located in remote regions, where they may employ original methods without fear of official censure. It is, however, unfortunate for the profession that their accomplishments are usually unheralded and often die with them. Dr. Fernow ⁶ summarizes this subject well and states

⁵ JOURNAL OF FORESTRY: Vol. XV, No. 1.

⁶ Fernow, B. E.: JOURNAL OF FORESTRY, Vol. XVII, No. 7, page 882

it succinctly when he writes that "Silviculture is based largely on empiricism, and that its methods vary according to local conditions and judgments. No two foresters may agree on procedure in a given case and yet both may be successful."

Silviculture embraces more problems, which have not yet been satisfactorily solved, than any other branch of forestry in Pennsylvania, and these problems lie at the very nucleus of rational forestry practice, and form the pivot upon which the whole forestry business turns. It would not be possible to enumerate all the silvicultural problems which are at hand and being worked on in Pennsylvania, much less could they be discussed in a single paper. Therefore, special phases of selected problems will be considered in the spirit of creating constructive discussion and promoting supplementary and supporting investigations.

Some of the most important silvicultural problems pertain to the planting of forest trees. Planting on the State forests began in 1899, when 1,000 trees were set out. During the first five years of this experimental and investigative effort only 16,800 trees were planted. The experiment soon grew into an established practice, for in the next five years (1905 to 1909, inclusive) over one million trees were set out. The growth of the practice was prodigious, for in 1910 the planting of forest trees passed the million mark and continued to increase until 1918 in which year over 6 million trees were set out.

The total number of trees planted to date (January 1, 1920) on the State forests is 33,806,338, which comprise the establishment of 1,131 separate plantations having an aggregate area of 22,168 acres. The establishment of so many plantations and the planting of so large a number of native and foreign trees made possible the outlining and pursuit of many interesting and original studies, of which some of the most important are:

1. Can plantations be established successfully?
2. Is fall planting of forest trees recommendable?
3. Can plantations be established economically?
4. Are plantations reasonably safe from fire?
5. Should planting of forest trees by private owners of forest land be encouraged?

CAN PLANTATIONS BE ESTABLISHED SUCCESSFULLY?

Whether or not plantations could be established successfully was a real and vital problem in the early days of the planting effort. In the

fall of 1916 an examination was made of all the plantations then located on the State forests and the percentage of establishment was as follows:

Species	Number of trees planted	Percentage of trees living
White pine	14,871,797	74.7
Scotch pine	1,334,234	76.1
Pitch pine	483,716	79.1
Red pine	893,355	69.0
Norway spruce	2,785,222	71.1
European larch	297,117	66.5
Red oak	294,877	33.8
Honey locust	110,950	39.3
Wild black cherry	64,340	39.7
Black walnut	33,505	53.2
White ash	104,045	51.4
Sugar maple	99,284	51.4

This table shows that most of the important coniferous species may be set out with the assurance that they will take hold of the soil and grow. Much better results are now being secured than the percentages of establishment given in the foregoing table, for it includes all the trial and experimental plantings made in the early days of the undertaking. In some of the recent and large plantations of white pine, pitch pine, red pine, Scotch pine, and Norway spruce as high as 95 to 98 per cent of the planted trees are living and thrifty. It follows that the technique of planting coniferous forest trees is now well understood, and that they may be set out with the assurance that most of them will grow, if the best knowledge of the practice is applied.

The raising and planting of hardwoods, however, is still in the formative period of its development and consists chiefly of trial plantings with uncertain results. The foregoing table shows an establishment ranging from 33.2 to 53.2 per cent. These percentages are low, the cause for which should not be placed entirely upon a deficient planting technique, for it is more difficult to determine accurately the establishment of deciduous than evergreen trees. Recent re-examinations of some of the hardwood plantations show a better establishment than was originally recorded. But in spite of the fact that the given percentages may be conservative, our knowledge of handling hardwood seedlings is still woefully deficient and unreliable. In order to overcome this deficiency to some degree a large quantity of different species of hardwoods was sown during the past year in the nurseries operated by the Department of Forestry with the hope that better methods of handling them may be devised.

IS FALL PLANTING OF FOREST TREES RECOMMENDABLE?

Spring planting of forest trees is usually recommended. It may be the preferable season, but a number of silvicultural and economic factors suggest occasional fall planting. The planting operations may be so large that the necessary labor is not available to do all the work in spring. The planting site may be so located that frost leaves the ground late in spring and growth starts immediately thereafter at a rapid rate. The planting stock may also consist of species which inherently start their growth early in spring. These factors appear to suggest fall planting, if a satisfactory establishment of the planted trees is possible.

In the fall of 1917 the Department of Forestry planted 10,000 seedlings on the State Military Reservation at Mt. Gretna upon sites ranging from swamps to hilltops and on soils varying from clay to sand. An examination at the end of the first growing season showed an establishment from 90 to 98 per cent of the trees planted. Numerous fall planting experiments have also been made on State forests, a number of them dating back as far as 1907, and some show a satisfactory establishment. These results, while fairly conclusive and comprehensive, however, do not furnish as adequate and accurate information as is necessary to practice fall planting with any positive assurance of success. Consequently, in the fall of 1918 a comprehensive planting experiment was outlined and established on six State forests located in as extreme parts of the State as possible.

Planting began on September 17, when 6,000 trees (1,000 each of six different species) were set out on each of the six State forests. Thereafter, approximately 6,000 trees (1,000 each of six different species) were planted at two-week intervals until November 30, when planting was no longer possible. The species used are: White pine, red pine, jack pine, Scotch pine, Norway spruce, European larch, Japanese larch, and white ash. Other hardwood species will be included in later experimental fall planting as rapidly as the planting stock becomes available.

This experiment comprises 24 separate plantations, which cover a wide range of moisture, soil, and existing growth conditions and are situated on different exposures and at different altitudes. It covers an aggregate area of 67.13 acres, required 141,235 trees and cost \$1,090.37.

No conclusive results are yet available, for only one growing season has elapsed since the experiment was started. But it is of interest to

know that the establishment of the trees in some cases is very satisfactory, for as high as 91 per cent of certain species are still living. One of the plantations on Snowy Mountain on the Mont Alto Forest, located at an elevation of approximately 2,000 feet, shows the following:

Species	Per cent of trees living (Dec. 1919)
White pine	91
Red pine	76
Jack pine	72
Norway spruce	82
European larch	72
White ash	91

If the fall planting experiments will finally show, as the preliminary results now indicate, that *some* species of forest trees may be planted successfully in autumn on specific sites, it will lighten considerably spring planting by extending the work over a longer period each year, and in addition place a crew of men in the forest during the fall fire season.

CAN PLANTATIONS BE ESTABLISHED ECONOMICALLY?

Each of the 1,131 plantations established on the State forests is regarded as an investigative project. A report is prepared for each plantation immediately after the completion of the planting operations, which sets forth all important information and data, including an itemized statement of costs.

A summarization of these reports shows that the Department of Forestry has expended to date (January 1, 1920) for forest tree planting \$204,425.93. The total cost of planting may appear high, but a careful examination of the total expenditures of the department from the time of its establishment until December 31, 1919, will show that approximately six million dollars (excluding the purchase of land) has been expended, and that forest tree planting averaged only $3\frac{1}{2}$ per cent of this expenditure, and during only one year (1918) did it reach 10 per cent of the expenditures of that year. Among the latest normal pre-war statistics of European States are those of Bavaria covering the years 1910 and 1911 which show that the expenditure for planting comprised 9.9 and 9.7 per cent of the total expense. If such an allotment is recommendable in case of normally stocked, and probably overstocked forests, and average annual expenditure of $3\frac{1}{2}$ per cent is not excessive for reforestation of forest land which is sub-normally stocked and in some cases entirely devoid of any important woody growth.

Some of the first plantations established between 1899 and 1905 cost from \$30 to \$47.50 per acre. The following table shows how the cost of planting was reduced by the introduction of practical planting technique and an efficient organization of the personnel:

Year	Average number of trees per acre.	Cost of planting per acre.	Cost of planting per M trees.
1906	2,655	\$27.97	\$10.77
1907	2,055	15.04	7.12
1908	2,080	8.73	4.20
1909	2,625	11.09	4.26
1910	2,265	13.09	5.51
1911	2,170	11.71	5.35
1912	2,035	13.31	6.72
1913	1,940	13.17	6.34
1914	1,465	8.66	5.88
1915	1,545	8.43	5.48
1916	1,325	6.10	4.60
1917	1,455	7.91	5.44
1918	1,480	10.81	7.35
1919	1,640	14.31	8.64

This table shows that forest trees may be planted now with our practical technique and efficient organization almost as cheaply as in the pre-war period when lower prices prevailed. The average cost of planting the 22,168 acres with more than 33 million trees was \$9.22 per acre or \$6.05 per thousand trees. All these figures include the cost of the planting stock, transportation charges, preparation of planting sites, forester's time, ranger's time, and planting labor. It seems to follow that planting may still be done economically if the technique used is practical and the organization of the personnel efficient.

ARE PLANTATIONS REASONABLY SAFE FROM FIRE?

The planting of forest trees was held up materially during the early days of the practice by the belief that plantations could not be protected adequately from forest fire, and consequently it might not be recommendable from the point of economy to expend from \$5 to \$10 per acre in reforestation. In 1909 a forester was assigned to the Penfield State Forest, and because of the belief prevalent in the locality that forest fires are inevitable and sure to recur at short intervals, he was afraid to plant trees in 1910, in spite of the fact that he was surrounded by many acres of desolation in urgent need of reforestation. A year of work in the community convinced him that the situation was improving, but yet he did not have the courage to undertake planting. The areas of desolation with which he was continuously surrounded, however, gave rise to a compelling desire to begin building up the

forest area in his charge; consequently in the spring of 1912 he ventured to set out some trees notwithstanding the popular belief that they would soon be burned. The undertaking, while somewhat adventurous, proved a great success. Planting operations have been conducted annually since this initial undertaking of 1912, and now over one million trees have been planted on this forest and not one of them has been burned. This example is not an exceptional one, but typical of most of the other 52 State forests. There are 1,976 acres of plantations on the Black Forest, 1,447 acres on the Blackwell Forest, and 1,717 acres on the Ole Bull Forest, and not a single tree has been lost by fire on any of them.

Since 1899, that is, for more than 20 years, trees have been planted on the State forests, and yet in spite of the large number set out (over 33 million), and the extensive area reforested (over 22,000 acres) only six-tenths of one per cent (.006) of the total planted area has been burnt over to date, which represents an average annual loss of three one-hundredths of one per cent (.0003). It is significant to know that this conclusion is not an estimate, but is prepared from reports based on accurate surveys of all completely and partially burnt-over plantations.

The results attained more than justify the foresters for their faith in reforestation, and reflect credit upon them for their fruitful constructive efforts. The foresters are in a position to note accurately the pulse of public sentiment, and they report almost unanimously that tree planting has done more than any other line of endeavor on State forests to develop tree appreciation and promote a durable sentiment in favor of forestry. They state that one of the best ways to protect forests against fire is to dot them with attractive plantations of vigorous and valuable trees.

It seems to follow from this 20-year-old experiment that plantations are reasonably safe from fire on Pennsylvania State forests; and that planting should be continued on all forest land upon which the existing growth is neither sufficient nor satisfactory, and where the prospect for natural regeneration in the near future is not promising.

SHOULD PLANTING OF FOREST TREES BY PRIVATE OWNERS BE ENCOURAGED?

Forest tree planting may be regarded as a business belonging primarily to the nation and State rather than the individual, but in certain

localities and under specific conditions the practice is also recommendable for private effort.

The planting of forest trees, both native and foreign species, has been a common practice in Pennsylvania since 1728, when John Bartram established his botanical garden on the banks of the Schuylkill River. In the early days, the effort consisted chiefly in planting individual trees or establishing groves, parks, or arboretums. About 1910 the early plantations established on the State forests began to show up and serve as real object lessons to the citizens of the State, most of whom had been skeptical about the outcome of planting small forest trees. The success of this novel undertaking was heralded across the State and private owners of forest land began to inquire about the advisability of reforesting their idle land. It soon became evident that the time was at hand for the Department of Forestry to launch a co-operative scheme for reforestation of thousands of acres of privately owned forest land within the State. In 1909 an act was approved by the Governor permitting the distribution of planting stock at *the cost of production*. During the first year of this co-operative scheme 66,374 trees were distributed to private planters. Five years of effort in this direction convinced those in charge of the work that a fuller degree of co-operation on the part of the State was recommendable. Consequently, in 1915, a new act was passed and approved which authorized the Department of Forestry to grow young forest trees and distribute them to persons desiring to plant them within the State, *the applicants paying only the cost of packing and shipping*.

The impetus which this act gave to private forest tree planting was almost phenomenal. The following table shows the prodigious growth of the practice:

Year	Number of trees distributed to private planters
1910	66,374
1911	25,360
1912	66,854
1913	47,770
1914	108,685
1915	115,577
1916	1,471,875
1917	1,812,997
1918	2,186,899
1919	3,139,631
Total.....	9,042,022

The planting of forest trees by private owners of forest land is now an established practice in Pennsylvania. The progressive tendency of the movement and the existing attitude of forest land owners indicate that the future is full of promise for this new business. More trees were planted in 1919 than during the first seven years of the undertaking (1910 to 1916, inclusive). The number of applicants increased from 23 in 1910 to 791 in 1919. The goal for 1920 is 1,000 applicants and the distribution of 4,000,000 trees.

The average number of trees distributed in 1919 was 3,969, indicating that the average area reforested per applicant was approximately two or three acres. The two largest applicants called for 180,000 and 135,000 trees, respectively. No order for less than 500 trees is accepted. This condition eliminates requests for a few trees for ornamental and other non-forestal planting. Among the applicants are farmers, lumbermen, recreation clubs, hunting clubs, water companies, mining companies, municipalities, and educational institutions. Water companies have been the largest and most consistent planters. To date they have received almost one and three-fourth million trees from the Department, and in addition have planted a large number of trees procured from other sources. The interest mining companies are beginning to take in reforestation, and the desire of land owners to replace the dead, dying, and damaged chestnut are the two most striking and promising developments of the past year.

It seems to follow from the results so far accomplished that the planting of forest trees by private owners of forest land in Pennsylvania should be encouraged. Private individuals and corporations are not planting forest trees as a pastime, but look upon the practice as a real business proposition. They desire to make their idle land attractive and productive, and to make some of their vacant corners work. The co-operative scheme worked out in Pennsylvania is practical, economical, and effective. It is producing good results, and regarded as the best line of forestry extension work. This form of extension work not only develops a favorable public sentiment for forestry, but teaches landowners, their managers and employees in a very practical and impressive way one of the important methods of handling a forest property.

SILVICULTURAL PRACTICE IN COPPICE-UNDER-STANDARD FORESTS OF EASTERN FRANCE

BY JOSEPH KITTREDGE, JR.

Forest Examiner, U. S. Forest Service

During the greater part of two years the writer had the opportunity, as an officer of the A. E. F., to be intimately occupied with the various phases of the cordwood operations of our army in the part of east central France between Dijon and the battle lines, chiefly in the Departments of Côte d'Or and Haute Marne. At different times he was concerned with the examination of various forest tracts with a view to the acquisition of the wood for our use; with the actual marking of the trees, to be reserved on one large private tract; and with the cordwood operations from stump to car. During practically the whole time the work required almost continuous co-operation on our part with the French forest officers in securing reasonable compliance with their silvicultural requirements by labor comparatively unskilled in handling an ax and totally unaccustomed to forestry practice. The relations established with the French officers, of the various grades, from conservateur (district forester) down to forest guard, were most amicable and satisfactory, both officially and personally. The following notes are therefore based on personal observation, directed and supplemented by contact with local French officers who were experts qualified both by training and experience.

DESCRIPTION OF FORESTS

Topography.—This part of France, where four of the large river systems—the Seine and Marne, the Meuse, the Loire, and the Saône—have their sources within a comparatively short distance of one another, is one of the poorest regions economically. Physiographically, it is a limestone plateau, with a general elevation of about 1,000 feet, which has been largely dissected and eroded away, so that the plateau level occurs only over small areas. The valleys are narrow and steep-sided, with frequent rock outcrops and ledges, and thin-soiled talus slopes. The valley bottoms are cut down from 200 to 400 feet below the plateau level.

Climate.—The climate resembles in many ways that of the vicinity of Washington, D. C. The annual rainfall is about 35 inches; with the drier season in the summer and snow in the winter becoming 5 to 10 inches deep, but rarely lasting as a cover for the ground more than a week or two at a time. Summer temperatures are much less extreme. The relative humidity is high and fogs are frequent.

In the so-called mountain forests under consideration, the difference in elevation and climate cause no differentiation of types, and the topography and aspect cause only minor variations in the proportion of species.

Type.—The type may be called the beech-oak-hornbeam type, since these are the predominant and characteristic species. In the larger valley bottoms there is also a hazel-alder type, with an overstory of oak and ash, which may be mentioned in passing, but will not be further considered.

Within the beech-oak-hornbeam type, a variety of species occur; they are indicated, together with their relative silvical characteristics, in the following table :

Species ¹	Per cent of standards	Per cent of coppice	Soil and moisture requirements	Tolerance	Sprouting capacity
Beech.....	20-80	10-30	2	2	8
Oak.....	80-20	10-30	8	8	5
Hornbeam...	5-10	20-70	3	1	1
Ash.....	10-5	5-10	1	3	4
Maple.....	5	5	5	4	6
Mountain ash.	5	5	7	5	2
Linden... ..	5	5	6	6	3
Cherry, apple, pear, etc..	1	1	4	7	7

Differences in topography, aspect, and soil depth and moisture account for the variations within the type. On the draw bottoms and lower slopes, ash becomes relatively abundant both in the coppice and the overstory. Oak and mountain ash are hardly noticeable. On the north and east slopes with moderately deep, moist soil, beech may form a nearly pure overstory, with hornbeam predominant in the cop-

¹ *Species.*—Beech, *Fagus sylvatica*; oak, *Quercus pedunculata*; hornbeam, *Carpinus betulus*; ash, *Fraxinus excelsior*; maple, *Acer campestre*; mountain ash, *Sorbus aria*, *Sorbus torminalis*, *Sorbus aucuparia*, *Sorbus domestica*; linden, *Tilia parvifolia*; cherry, *Prunus domestica*; pear, *Pirus communis*; apple, *Malus communis*.

pice. On the south and west slopes and on the plateau level where the soil becomes shallow, dry, and rocky, oak predominates in both stories, with considerable mountain ash, some beech, and a little hornbeam.

The proportion of species is to some extent in forests which have been under management for several rotations, the result of silvicultural practice which in turn is partly guided by the relative value of the different species.

Management.—These hardwood forests, whether under private, government, or municipal ownership, are managed to furnish a sustained annual yield. The regulation of the annual cut is on an equal-area basis. Forests as small as 40 or 50 acres may contain a complete cutting cycle. The rotation depends upon the age at which the coppice reaches an average size which gives it a ready sale as fuelwood. On the better soils this age may be as low as 20 years and on the poorer soils, especially on the State forests, it may be as high as 40 years; 30 years was about the average in the region under consideration. In other words, a forest is divided into 30 parts of equal area, one of which is cut over each year. Thus a complete series of age classes from 1 to 30 years is always present.

The standards are composed of those trees which are reserved to grow for more than one rotation. Some of them are cut at the end of each 30 years, but a few of the best and thriftiest may be reserved over as many as six coppice rotations, or until they are 180 years old. At the time of cutting there are present standards of all the intermediate age classes; that is, 60, 90, 120, and 150 years.

Marking.—The marking is done in the spring before the leaves come out and when the trees are easily visible for reasonable distances. It would be almost impossible in the dense coppice after the foliage appeared. As a first step, two or three of the gardes brush out a series of straight lines across the area, usually parallel to one of the sides. Sometimes a compass is used, more often one man simply lines the others in. The smaller sprouts and brush are cut off at 6 inches or 1 foot from the ground, just enough so that the line is readily detected and followed. These lines are from 50 to 100 feet apart.

The technical forester in charge then has from three to five or six of his rangers and gardes meet on the parcel for the actual marking. He carries the tally book and each of them has a marking hatchet with the poll bearing the raised stamp of the owner. The party works back and forth across the area between two of the brushed lines, the rangers

and the gards abreast, so that each one covers a strip about 20 feet wide. The one on either end is guided by the cleared line. This method has been developed to permit and assure that the markers see every tree on the area, so that no desirable tree to be reserved may be overlooked and cut. The officer in charge follows a short distance back of them, where he can watch the selection of trees to be reserved and at the same time tally the trees as they are called off by the men. They are tallied by species and by 20-centimeter circumference classes ($2\frac{1}{2}$ -inch diameter classes). All the trees $7\frac{1}{2}$ inches in diameter and under which are reserved are thrown into one class. Similarly the trees to be cut are separately tallied by the same circumference classes, and by principal species; for example, oak, beech, and miscellaneous other species. The reserves are lightly blazed close to the ground and stamped once or twice, depending on the size of the tree; trees under 8 inches, once; trees 8 inches to 16 inches, twice; trees over 16 inches, once. The reserves in coppice stems are sometimes scribed once instead of being blazed and stamped. The trees to be cut, which are over 8 inches d.b.h., are blazed at breast height, and the coppice stems to be cut are let unmarked.

Economic conditions have an important influence on the character of the marking. The owner who wants the maximum immediate financial return instructs his forest agent to mark heavily the larger trees which have the highest value. On the other hand, a far-sighted owner with a well-lined pocketbook, who wants an attractive forest hunting ground and who sees that large timber, furnishing high-grade lumber, will command relatively higher prices in the future than now, may desire to have a large number of the best trees reserved, even to the point of transforming his coppice under standards to high forest. Just prior to the war, in that part of France, much of the charcoal wood which makes up one-half to two-thirds of the product from the coppice, had no sale value on the stump. This was a strong incentive to reserve heavily and get higher yields of valuable timber in subsequent rotations at the expense of the coppice. During the war, cordwood increased in value relatively more than the timber and on a given area often had a higher aggregate value. This condition was temporary, however, since for many years France has been self-supporting in cordwood supply, while she has been obliged to import large quantities of lumber products. An example brings out this interrelation of demand and value and their effects on the marking practice. Before the

war, a hectare, yielding 10 cubic metres at 30 francs per cubic metre, brought 300 francs, stumpage for the larger trees. The same hectare had a stand of 100 steres (stacked cubic meters) of cordwood, of which only one-third was merchantable at a price of 4 francs a stere, so that the cordwood was worth only 125 francs. During the war, the same hectare brought 500 francs for timber at 50 francs per cubic meter, and 600 for cordwood at 6 francs a stere.

The relative values of the different species are, beginning with the most valuable, ash, oak, beech, cherry, mountain ash, linden, maple, and hornbeam. Of course, these relations vary somewhat with local specialized demands.

While economic conditions have their effect in a broad way on the number of reserves, the real guides in marking are the silvical factors. On north and east slopes and in the bottoms on good soil, ash and beech are favored. Oak under these conditions becomes sickly and dies out usually before it reaches timber size, so that even where good specimens are present in the coppice, they are rarely reserved. Cherry and mountain ash are not often found on these sites, but thrifty, well-developed individuals are reserved where they occur. The hornbeam, linden, and maple are only left where a tree of better species cannot be found to fill too large an opening.

On south and west slopes and shallow, rocky-soiled uplands, the cherry and mountain ash are strongly favored, although they do not become as large a proportion of the stand as oak, which is the species chiefly reserved. Linden is not undesirable occasionally. Maple and hornbeam are reserved only where better species are not present. Beech and ash require deeper, moister soils.

Perhaps the most striking feature of the marking is the absolute insistence on reserving the very best individuals to be found on any given area. Every tree is examined and the thrifty, well-developed specimens of good species are reserved, even though they may already be of a size to command a high sale value. The number per unit of area is not considered a guide in marking as compared with the selection of the reserves. Among the standards which have already lived through two or more coppice rotations, those are left which promise to thrive and grow rapidly during another 30 years. In the coppice itself individuals are selected which are straight and comparatively full-crowned as a result of having grown a little faster than their neighbors, so that they have made room for themselves. Usually only the

best one of a clump of sprouts is left. In the case of beech, where two of the sprouts from one root are in good condition and co-dominant, both specimens are reserved. The poorer one of these two is almost invariably cut at the end of the second coppice rotation. For the mountain ash, which develops several sprouts per root, all of the healthy ones are reserved over a second rotation, at the end of which usually all but one are cut. While the markers are primarily concerned with reserving all the best trees, the results in uniformity of spacing are surprisingly good.

The density of the stands and their composition by sizes before cutting are indicated by the following figures. At 30 years of age, the coppice, including only stems that have reached a diameter of 1 inch or more at breast height, may run from 1,200 to 7,000 trees per acre. Even assuming that an average of six sprouts grew per stump, a spacing of 6 by 6 feet would be indicated. As a matter of fact, about three is the average number per stump; in other words, the coppice forests are surprisingly dense. They develop complete canopies before they become 10 years old. The coppice stems at 30 years old run from less than 1 inch d.b.h. up to 5 or 6 inches for a few of the fastest growing species on good sites. The heights range from 10 to 30 feet. An average tree would be about 3 inches d.b.h. and 20 feet high.

The standards of 60 years old vary in number from 30 to 150 per acre, depending on the marking policy of the owner, the quality of the site and consequent condition of the trees. They run from 4 or 5 to 10 or 12 inches in diameter and rarely attain a height of over 40 feet. After 30 years' growth in the open, they have usually developed well-rounded and branching crowns and are putting on diameter more than height increment.

The trees of 90 years and over are comparatively scattered. As a criterion of age in this case, a minimum diameter of about 11 inches d.b.h. is assumed. There may be from 4 to 20 per acre of these trees. Occasionally a beech, oak, or ash may have a diameter of 3 feet and a merchantable length of four 16-foot logs. The trees after the third coppice rotation, when they are still reserved for growth, develop very large crowns and occupy wide areas.

In considering the interrelation between the coppice and the standards, that is, all the trees more than one rotation old, the reserves have a fairly uniform spacing averaging 20 to 35 feet, trunk to trunk. In other words, each tree that is reserved has full overhead and side light

and the best conditions for maximum increment growth. On the other hand, the effect of a moderately heavy crowned tree every 20 to 40 feet is a potent one on young sprouts and seedlings.

Beech especially casts a heavy shade and under a large beech standard, practically no sprouts even of the tolerant hornbeam are to be found. However, the hornbeam sprouts do well for a single rotation directly under the crowns of any of the species except beech or rarely hornbeam itself where a standard has been reserved. The beech reproduces often as seedlings. The stumps and especially large stumps sprout very poorly. The young trees grow well under the shade of the other species except beech and hornbeam. For the other species, oak, ash, maple, linden, mountain ash and cherry, direct overhead light is an essential requirement. The aggregate effect of a heavy reservation of standards as compared with a light one on the coppice is reflected better in a comparison of yields of the coppice. One area in which perhaps only 100 standards have been reserved per acre, and those chiefly of oak and light-crowned species, will produce a complete and dense stand of sprouts which will yield perhaps 13 cords per acre. Another area on which 200 trees per acre have been reserved, chiefly large beeches, will yield less than one-half as much cordwood from the coppice, the difference being due wholly to the greater abundance, size, and crown density of the standards. On the average, the yields of coppice grown under standards are only one-half what they would be if the standards were not present. From 5 per cent to 20 per cent of the stumps do not sprout successfully as a result of the shading and the balance of the difference is due to slower growth of the sprouts that do start.

A few examples, taken from actual notices of sale in the region, will help to make clear some of the points which have been made. These examples are taken from the advertisements of the sale of timber from *Stâte* and communal forests in the region. Private owners ordinarily do not give so much detail in their notices:

Art. 2—2nd Series Bonniere—Coupe No. 15.

26.8 acres of coppice-under-standards, 34 years old, a total of 564 trees to be cut, as follows.

	D. b. h. in inches				
	7½	10	12½	15	20
480 oaks	432	36	8	3	1
7 ashes	6	..	1	..	..
77 beech and miscellaneous.....	73	2	2	..	..

The oaks will produce 3 cubic meters, log measure (630 feet board measure) and the other species 1 cubic meter (210 feet board measure) (the coppice, 600 steres).

Reserves: Coppice (scribed): 106 oaks, 43 beeches, 396 other miscellaneous species; small standards; 55 oaks, 51 beeches, 16 mountain ashes, 23 ashes, 10 maples. 2 lindens: large standards, 1 beech. All mountain ashes are reserved.

This was a poor forest on a shallow rocky plateau for the most part. Art. 6—3rd Series.—Detain-Gergueil—Coupe No. 14.

19 acres of coppice-under-standards, 42 years old, total 409 trees, as follows:

		D. b. h. in inches.									
		7½	10	12½	15	17½	20	22½	25	30	35
189 oaks	111	45	21	9	3	..	..	..	..	..	..
5 ashes	2	2	1	..	..	..	..	..	..	..	..
215 beeches, etc.....	105	33	25	13	12	11	6	8	1	1	1

The oaks will produce 17 cubic metres log measure (3,600 feet board measure) and the other species 66 cubic metres (13,500 feet board measure).

Reserves: Coppice (scribed): 22 oaks, 1,250 beeches, 369 other; small standards; 81 oaks, 340 beeches, 25 mountain ashes, 17 maples, 1 linden, 9 ashes, 2 pears, 3 cherry, 1 apple; large standards: 76 beeches.

All mountain ashes and conifers are reserved.

This was an unusually good coupe for the region.

Sales and Cutting Regulations.—The regulations governing all government sales are printed in pamphlet form for all France. A few of the interesting paragraphs follow:

All sales areas will be sold for a lump sum, without guarantee as to area, number of trees, volume, species, age, or quality.

On areas of coppice the trees will be cut with the axe as near the ground as possible, and in such a way that the water can not remain upon the stumps. The roots must be left intact.

On areas of high forest, trees will be cut level with the ground, with the axe or with the saw.

Trees will be felled in such a way as not to damage the reserves, and directed, in so far as possible, toward places devoid of seedlings. On parcels on steep slopes, they will be felled perpendicular to the contour, crown toward the top.

Currently with the felling, in parcels of coppice, the purchasers must cut off level with the ground the stems trailing or upright of thorns, brambles, and all worthless brush.

The felling of the trees will be terminated by April 15. This is required so that the felling will be complete before the sap begins to run in the spring. When trees are cut during the summer, the new sprouts do not start as readily and are subject to various fungus diseases which threaten the future of the coppice.

It is forbidden to peel or bark any standing trees of those included in the sale.

It is forbidden to allow any branches to remain on top of reproduction; or to pile any wood upon seedlings, upon live stumps or against reserved trees.

The purchaser will respect all reserved trees, no matter what may be their condition or their number.

When reserved trees are unavoidably felled or broken, the purchaser must replace them by trees chosen from those abandoned by the local agent of the Waters and Forests Service, and the value of such trees will not exceed that of those replaced.

The damage value of reserves will never be less than the following minima in parcels of coppice-under-standards: (1) A reserve of coppice age, per $1\frac{1}{4}$ inches of diameter breast high, 3 cents; (2) a reserve of 11 to 16 inches in diameter breast high, 6 cents; (3) a reserve over 16 inches in diameter breast high, 10 cents. This is the equivalent per average tree, of class 1, 8 cents; of class 2, 70 cents; of class 3, \$1.60.

If reserves are damaged, the procedure will be the same as if they were knocked down.

Unless there are stipulations to the contrary, it is forbidden (1) to skid logs on the hauling roads; (2) to chute or roll logs down the slopes; (3) to allow animals to graze in the forests or even enter parcels containing young growth without being muzzled.

When the purchaser does not wish to utilize the brush, he may burn it at points designated by the forest agent, unless the agreement expressly authorizes scattering the brush. As a matter of fact the brush almost always is utilized. In the region under consideration, scattering brush is permitted on State forests. This is because the fire danger is at a minimum owing to the frequent rains and fogs, and the brush conserves the moisture, does not interfere with the sprouts and in decaying enriches the soil.

Under penalty of the law, all reserved trees will be accounted for by the purchaser at the time of the recount. After an exploitation is completed, the local forest officer recounts all the trees left and the

purchaser is charged at the above rates for any difference between the original tally of the reserves and this recount.

Utilization.—The hardwood forests furnish a variety of products from each parcel. The trees over about 10 inches in diameter are cut into single logs, full length to a top diameter of 4 to 6 inches. The stems are hauled off the forest in this form. The material in the coppice and in the tops from 3 to 6 or 8 inches in diameter is cut usually into 52-inch lengths and piled for cordwood. The smaller stems and branches from three-quarters inch to 3 inches in diameter are cut into 26-inch lengths and piled. Later this wood is usually converted into charcoal right on the ground or hauled to a nearby hardwood distillation plant. The twigs below three-quarters-inch diameter are bound into bundles with limber twigs and hauled away for local use as kindling. Thus complete utilization is secured.

Yields.—The yields vary widely. In logs they run from practically nothing up to 10,000 board feet per acre. The average, however, is only 500 to 1,000 board feet per acre. The cordwood, including both sizes, or all material between three-quarters inch and 6 inches in diameter yields from 5 to 20 cords of wood per acre, averaging 10. Of this, on the average, from one-fourth to one-half is the larger wood from 3 to 6 inches in diameter. From 5 to 10 per cent of it comes from the branches of the larger trees, which are cut into logs.

To an American, the following features of French silvicultural practice stand out as at least suggestive:

- (1) Intensive forestry is being practiced by private owners to their financial advantage.

- (2) The management is of a very simple type and depends more upon the local forester's intimate knowledge of his forest and silvicultural good judgment than upon complicated working plans.

- (3) The absolute insistence in marking upon the reservation of all the best individual trees, more or less regardless of what their number per unit of area may be.

- (4) The complete control down to the smallest detail by the local forest agent of all the operations which go on in the forest. The logger must practically submit to having his job run by the forester.

THE FOREST SITUATION IN FRANCE

By R. C. HALL

RESULTS OF PAST POLICY

French forest policy as developed in the past was more than justified in the course of the World War. The allotment of approximately 18 per cent of the land area to timber production, the accumulation and maintenance of ample growing stocks, the resulting permanence of forest industries and protection to sources of water power, were elements of great economic strength to France in the recent struggle. These facts did not fail to impress the lumbermen and foresters of the American Expeditionary Force, who for the first time in their lives conducted logging operations in forests that have been systematically controlled by man for many generations on land which in the United States would probably have been allowed to become barren mountain slope or sandy waste.

Ocean transportation was one of the decisive factors in the war. The strain on Allied shipping was tremendous and any relief was of greatest benefit. The forests of France not only met the needs of her own armies, but also the bulk of the requirements of the Belgian, British, and American forces. The total amount of timber they furnished for war purposes is not known, but according to preliminary French estimates is about 40 million cubic meters or ten billion board feet. By obtaining timber supplies in France there was saved to the American Expeditionary Force alone cargo space amounting to over a million and one-half tons. The British Army produced in France for themselves and for the French over 3,800,000 tons of forest products, besides what they obtained by purchase from contractors.

The fuel situation became very serious in France during the latter part of the war. Her best coal fields were in the hands of the Germans, and most of the coal obtainable had to be allotted to munition factories and essential industries. Here again the forests played an important part, and much suffering was avoided. For some years before the war there had been, owing to the increased use of coal for domestic purposes, an oversupply of fuelwood. In many coppice or coppice-under-standard forests cutting had been abnormally retarded

on account of lack of market. This material was substituted for coal wherever practicable, becoming a most valuable resource, and incidentally benefitting the owners before the war was over to the extent of five to ten dollars per cord stumpage. There was also a considerable saving in fuel requirements through the extensive use of waterpowers which in turn owed their existence in part to the reforestation and conservation of existing forests on their watersheds.

A more indirect effect of France's forest policy was that upon her man power. Woods work has always produced a strong and self-reliant type of man, toughened by exposure and able to withstand the hardships of life in the camps and trenches. The permanent character of French forest industries maintains a class of men of this type and has given them permanent homes. They have done their share to protect these homes by making no small contribution to their country's armies. Many a "blue devil" of the famous chasseurs won his sturdy endurance and resourcefulness in the woods.

The direct military value of forests in defensive warfare has drawn frequent comment. The extensive forest groups north of Paris were undoubtedly of immense value to the Allies in checking the enemy advance on the city. This assistance was counterbalanced, in part, at least, by the value of the forests to the enemy in strengthening his lines of occupation in northern France. The chief contribution of French forests to the allied victory was on the economic side.

CONDITIONS DURING THE WAR

What was the forest situation at the outbreak of the war? France had 9,886,700 hectares or about 24,400,000 acres in forest. Of this the State owned 1,199,400 hectares or 3,000,000 acres, the Communes (including also certain public establishments) 1,948,600 hectares or 4,800,000 acres, and private parties (including a few Communes not under Government forest management) 6,738,700 hectares or 16,600,000 acres. The State forests were mostly in excellent condition, with ample growing stock and reserves of large timber. In some more inaccessible forests the growing stock was excessive. The average production of sawtimber per hectare was 0.84 cubic meters, against 0.65 cubic meters for communal and private forests, which produce more fuelwood.

The private forests contained a very important quantity of timber. They varied greatly in quality and productivity, but were very inferior

to the State forests in the production of timber of large size. This was due to the use of shorter rotations which are financially more profitable than the longer rotations applied to State forests, to the tendency to increase immediate returns by premature cutting, and to the frequent lack of continuity in ownership, all of which are factors that operate in France in spite of the high level of stumpage values. The Communal forests were on the whole somewhat more conservatively and skillfully managed than the private forests, but more subject to local needs and financial considerations than the State forests. For the most part they enjoy the same technical supervision as the latter. Their production is not far different from that of the private forests.

At the outset of the war France lost control of the important forest regions in the North that were occupied by the enemy, but during the first two years the demands upon her forests that remained were not extraordinary. At first practically all forest operations were stopped by calling to the colors of all able-bodied lumbermen and foresters. Later, as the development of trench warfare, the building of extensive munition plants and depots, light railways and other appurtenances of modern fighting, required timber in excess of existing stocks, men were released and exploitations resumed. Almost no timber was cut in the fall of 1914, and only a moderate amount in the year 1915. In 1916 a much larger quantity was manufactured, the demand for military purposes increasing all the time. This demand reached enormous proportions in 1917 with the entry of the American Expeditionary Force requiring almost wholly new equipment and housing from the docks at base ports to entanglement stakes at the front lines. It continued unabated until the armistice was signed.

It became obvious that to meet this demand a cut much in excess of the normal yield based on the annual growth was called for. How should this excess cutting be distributed? One might think that the State owned forests would have had to bear the burden. This was not the case. It is true that considerable pressure was brought to bear by the wood services of the American, British and French armies to obtain heavier cuttings in State and Communal forests, with the result that cutting three to five years in advance of normal was authorized, and the principle recognized that in the more difficult and inaccessible operations, even heavier markings, anticipating ten years' yield, should be allowed. However, the conservatism of the French Forest Service, the reluctance to see working plans seriously deranged, and

the feeling that a reserve must be kept for reconstruction and for local wood using industries after the war, prevented any serious over-cutting of the public forests. Show places, such as Fontainebleau and Rambouillet were scarcely touched. Even forests on the very fighting lines, for example those of Compiègne and Villars-Cotterets, still possess magnificent stands of saw timber. Some of the inaccessible mountain forests were actually benefitted silviculturally by the removal of over-mature timber not marketable under ordinary conditions or left standing on account of extreme conservatism.

The excess war production of timber, leaving out of consideration the occupied territory, was largely at the expense of private forests. The rapid increase in timber values which began in 1916, augmented enormously in 1917, and continued to mount in 1918, offered to owners of timberlands a tempting opportunity to dispose of their products at previously unheard-of prices. Naturally speculators commenced purchasing forests to hold for resale at big profits, and would have added greatly to the inflation had their activities not been checked through centralized buying by the Allied armies and use of the power of requisition. However, war prices were so elevated that many owners considered it good business to take advantage of them regardless of the effect on their forests and consequently sold for very heavy or clear cutting. Others compromised on moderately heavy cutting, and others who did not wish to sell at all were forced to do so by threat or use of requisition. When the power of requisition was used, however, cuttings were always conservatively marked and scenic interests guarded most conscientiously. A forest was never devastated against the owner's will. Nevertheless buying pressure was so great that private forests, which constitute over two-thirds of the total wooded area, were very heavily overcut.

PRESENT PROBLEMS

The close of the war finds French forest resources seriously depleted but by no means exhausted. The loss in the invaded region of the North, especially in the well wooded Departments of the Aisne and Ardennes, was very heavy, both from military operations, including shell fire, and from confiscation by the enemy. In the zone of severe and long-continued fighting there was about 150,000 hectares or 370,000 acres of forest. All of this was badly damaged and much of it practically destroyed. The total loss is not known, but the best estimate is

about 15 million cubic meters (3,750 million board feet), whereas the normal annual production of this region is only a little over one million cubic meters.

Outside of the invaded region there remain the State and Communal forests, somewhat overcut in places, but still containing important reserve stocks of timber available for reconstruction, and the extensive area of private forests, for the most part badly depleted and in need of recuperation.

The forest problem of today is threefold, involving first, restoration in the invaded region, second, a decision as to the extent to which present needs for timber may be safely met by public forests, and third, promotion of the recuperation of private woodlands.

The restoration of the forests destroyed and damaged by the invasion is a relatively small item in the vast program of rehabilitating the war-torn provinces, and must wait until the more pressing needs of the returning population have been met. An area of about 200,000 hectares will have to be planted, the destruction being too complete to permit of natural regeneration. This alone represents a cost under present conditions of 80 million francs. The remaining 300,000 hectares of forest in the damaged areas will require many years to reach the point where a normal yield can again be realized. Of course it is expected that an indemnity will be exacted for this damage, but it doubtless will not compensate for the economic loss of greatly reduced local timber supply for a long period of years. Furthermore, it is likely to be slow of collection, and still slower of distribution to private claimants.

The State and Communal forests outside of the invaded region contain the only large amounts of domestic timber that might be available for reconstruction. France cannot afford to import much timber at present on account of high base prices in the countries which have timber for sale and the unfavorable exchange rates. Germany alone, an exception on account of the depreciation of the mark, might be able to supply a limited amount of timber to France at reasonable cost, and may be required to do so as a reparation measure. Large reserve stocks of lumber manufactured for military purposes are also available for reconstruction. Nevertheless it is reasonable to expect that there will be a large demand for timber from French forests for a number of years, and that this will have to be met to a large extent by the public forests. Therefore it is likely that there will be strong pressure

to continue cutting in advance of normal until the most pressing needs have been met, when such recuperation as is called for can be commenced. In spite of such pressure there is no likelihood of dangerous overcutting under the present control. In this connection it is interesting to note that the French Forest Service has prepared to meet the changed conditions and heavy tasks that confront it by a reorganization of personnel. The objects are to secure more decentralization, less paper work, and greater efficiency, so that the present force, greatly reduced by the war, can handle the necessary work. Increases over pre-war salaries are also included in the plan.

The problem of improving the condition of private forests is serious but by no means hopeless. It pays to grow timber at French stumpage prices. The forests that are still in good shape are owned by wealthy and conservative citizens who can be counted on to exploit the normal production only. Much of the money reaped from the depletion of the others is in the hands of their present owners who can thus afford to protect and build up the stand without expecting much additional revenue for some time. Some of them will doubtless adopt this policy. Other forests which fell into the hands of speculators and were passed on to new owners are less likely to have a good chance of recuperation. It is impossible to avoid bringing a forest into some measure of productivity to meet carrying charges, since in France an owner is not allowed to pull up the stumps and convert the land to other uses without showing to the satisfaction of the Minister of Agriculture that the public interests will not suffer thereby. Experience has shown, however, that this necessity is not sufficient to insure far-sighted management of timbered property. Financial exigencies of the owner, slowness in the realization of returns from planting or other improvement, forced partition among heirs when the owner dies and consequent overturning of working plans, are among the causes which have always led to the bad handling of private forests regardless of war conditions.

French foresters were dissatisfied with the status of private forestry before the war. The chief trouble was that private enterprise did not produce enough timber of good size to meet the demand. The effort to improve conditions that was then being made will be resumed. France's present financial condition precludes measures involving the expenditure of public funds on a large scale. This will prevent for the present the purchase of private properties to increase the area of State forest, a measure which is regarded as desirable in spite of the large

proportion of forest land already under State ownership and management. However, arrangements are being made to administer the act of July 2, 1913, known as the "Audifred" law, the operation of which was retarded by the war. This act has the object of "encouraging the replanting and conservation of private forests." It authorizes savings banks to invest up to one-tenth of their reserves in timber lands, and public service corporations to make similar investments. It requires these and other semi-public institutions such as hospitals, annuity companies and mutual aid societies to submit their woodlands to the "régime forestier," that is, to management by the Government Forest Service on the same general terms as apply to the Communal forests, most of which have long been administered in this way. It also authorizes the submission of private forests to the "régime forestier" under such contracts as may be agreed upon for each specific case between the owners and the Forest Service. These contracts may provide for protection against fire and trespass and inspection of cuttings only, or for complete administration by Government forest officers. Their exact terms are not prescribed, except that they must have a duration of at least ten years. It is rather doubtful whether any great number of private owners will desire to sacrifice their independence of control for the advantages of Government assistance, but the encouragement given to conservative forest enterprises on the part of long-lived, semi-public corporations to the requirements of which such investments are especially suited, seems likely to produce good results in the course of time. In any case, economic conditions favor fairly rapid recuperation of private forests to conditions at least as good as those prevailing prior to the war.

Aside from the big loss in the invaded region where the restoration of the forests is an important but relatively small part of the necessary re-establishment of normal conditions, the forest situation in France is not so much worse owing to the war as might be expected. This is largely due to the careful management of her woodlands exercised through many years past. Her public-owned forests are in good condition to meet the most pressing demands of the present, and while her large area of private forests is badly depleted, there is a definite policy of encouraging their improvement based on sound economic principles. The situation is better than in England, where the war forced the sacrifice of many beautiful park woodlands because there were no commercial forests. There the lesson is now being applied through

the adoption of a forest policy with the purpose of becoming less dependent on imports for the most essential timber supplies. If the situation in France points a moral for the United States it is the great economic value to a country of a consistent and far-sighted policy applied to both public and private timberlands. There is also an answer to those who fear that forestry in this country may divert land from higher uses and retard agricultural development in the fact that in an old and thickly populated country where the requirements for food production are large and agriculture is practised on an intensive scale it has been found profitable to keep so high a proportion of land in forest. The unsatisfactory status of French private forestry is also a strong argument for the extension of Government-owned forests in the United States where for a long time the economic conditions affecting private forestry are bound to be less favorable than in France.

EARLY ENGLISH FOREST REGULATIONS

BY JOHN D. GUTHRIE

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It is interesting and perhaps instructive to the forester of today ir handling the problems which confront him to read of the problems and difficulties which has confronted foresters of old. Some of these questions and difficulties as they occurred in early England are very completely covered in the very interesting book by John Charles Cox,¹ without which the writer considers no forester's library complete.

The early English conception of a forest was totally different from our present-day conception in America. Manwood, in his "Lawes of the Forest," published in 1598, describes a forest as "a certen territorie of wooddy grounds and fruitful pastures, privileged for the wild beasts and foules of farrish, chase, and warren, to rest and abide in, in the safe protection of the King, for his princely delight and pleasure." This definition largely describes the English view of a forest for many centuries, and even to some extent today. The Encyclopedia Brittanica defines a forest as "a tract of country covered with trees, of one or several species, or with trees and underwood." This is the generally accepted meaning, but according to Manwood's definition it is not historically correct. Wedgwood considers "forest" as a modified form of Welsh *gores*, *gorest*, waste, waste ground; whence the English word *gorse*, furze, the growth of waste land. Other authorities² give the derivation of the word a Teutonic origin, namely, *voorst*, the segregated property of the King or leader of the tribe. The word is also given by other writers as being derived from the Latin *foris*, out of doors, the unenclosed land. At best, as Fernow says, "the etymology of the word is doubtful."

Whatever the derivation of the word, the fact remains that "forest" originally did not mean what we now understand by it, a description of natural conditions, but was a legal term designating a territory set

¹ "The Royal Forests of England." By John Charles Cox, LL. D., F. S. A. The Antiquary Books Series. Methuen & Co., 36 Essex St., London. 1905. Pp. 372.

² See Fernow's "Economics of Forestry," pp. 81-84; 448-450.

aside as a hunting ground for the king or his vassals, administered under special laws and special courts, the officials being mainly law officers and police. "Afforesting" and "disafforesting" were the legal terms for creating and abandoning the reservation.

According to Cox, the history of the English forests may be divided into three periods: from the earliest times up to 1217, when the Charter of the Forest of Henry II was granted; from that date up to 1301, when large tracts were thrown out of the forests by Edward I; and thirdly, from 1301 to the present time.

There were forests, chases and parks under the English system. The accepted definition of a forest was a portion of unenclosed territory consisting of extensive waste lands, and including both woodland and pasture, defined by metes and bounds, within which the right of hunting was reserved to the King, and which was subject to a special code of forest laws administered by local as well as central officers. A chase was also unenclosed land, but could be held by a private individual. Offenses committed within it were subject to the common law and not to forest jurisdiction. The words chase and forest were at times used interchangeably. A park was an enclosure, fenced off by pales, or a wall, or hedge. A forest might contain several parks. Forest law held over these parks located within a forest, but not those outside a forest. The number of forests, chases and parks varied greatly from time to time. According to an estimate made during Queen Elizabeth's reign, there was a total of 69 forests, 13 chases, and more than 700 parks in England.

For purposes of contrast and comparison, the writer has grouped roughly the forest activities of early England into lines of work used in the Federal Forest Service in the United States; also he has converted the English currency rates into American equivalents wherever money values are stated.

PERSONNEL AND ADMINISTRATION

There was a distinct organization for handling the forests and forest business in those days. This business bears a striking resemblance to that on our National Forests today, and the similarity makes one realize the verity of there being nothing new under the sun. Administrative and personnel problems seem almost as troublesome then as they are today.

The chief local authority of a forest was the keeper or warden or chief or master forester. This title varied with the different forests

and even with the same forest at different periods. The office was often hereditary, even being held by women. Writs relative to the administration of the forest business were addressed to this chief or master forester. He presided personally or through his deputy at local forest courts. The position had considerable perquisites and privileges, and the holder was allowed to distribute a certain amount of venison to the country gentlemen of the district without a direct warrant. For each forest officer there was a symbol, representative of the authority of his office. The symbol of the master forester was a bow, while that of an ordinary forester was a horn (compare this with the horn used by French foresters on their uniforms).

Foresters were officers sworn to preserve the vert (timber) and venison in their districts. They could attach (arrest without warrant) offenders. They had certain rights of pasturage and pannage. They were paid on a per diem system, for seven working days per week, for 365 days per year. In 1483 the wage was 4 cents per day. In earlier days foresters appeared to have been quartered in whole or in part on the tenants of the forest. These perquisites were called *puture*. One forester in the Year Book of Edward III claimed food and drink at the Abbot's table (of St. Mary's, York) every Friday; also the right to carry away, whenever he pleased, a flagon of the best ale, two tallow candles, a bushel of oats for his horse and a loaf of black bread for his dog.

General forester. There were also general or itinerant foresters for a whole area, who had a higher rate of pay than a local forester. These general foresters were mounted, and hence were frequently called the riding foresters.

Verderers. These were forest officers directly responsible to the crown, although they were elected by the free-holders in the county courts on writ addressed to the sheriffs. They were elected for life, but could be removed for incapacity or for lack of due property qualification. They were men of position and were frequently knights. There was no salary with the position and perquisites were the exception. Their number varied greatly; the smallest forests having only two, while Sherwood Forest had six. Their duties were to attend all forest courts, decide minor trespass cases, etc. The symbol of their office was an axe.

Woodwards were officers primarily responsible for the actual timber or vert. On some forests at different periods they were also responsible for the game. Owners of lands within the forest could do no

clearing, build no houses nor sheds, nor forges, nor burn charcoal, without the King's permit, for fear of disturbing the deer. To look after such work the woodwards existed. Their symbol was a small hatchet or bill-book. Later there was a chief woodward, who was called the axe-bearer.

Agisters were officers chiefly concerned with the collection of money (fiscal agents) for the agistment or feeding of cattle, hogs and sheep; though the use of the forests by sheep was much restricted, and goats were rarely allowed within a forest. The agisters reported to the verderers cases of agistment and of escapes of animals into the forest (trespass).

Rangers were not heard of until the end of the Fourteenth Century. Their duties were originally confined to seeing that the forest law was duly observed in the outlands or purlieus of the forests. Their office later corresponded somewhat to that of the mounted foresters, and from this old use is probably derived our modern conception of the word.

Regarders. These officers were responsible for the regard or survey of the forest. Not less than twelve could make a certificate of their "view." When making the review the foresters and woodwards were required to be present with the regarders.

Parkers. This was another class of officers, keepers of the parks. They not infrequently had under them palers, palesterns, or palifers, who were permanently employed to maintain the pale fences of the parks.

The forest force on certain forests was quite large. Sherwood Forest, which was some 25 miles long by about 10 miles wide, had, in 1538, the Earl of Rutland as keeper of the game, Sir John Byron as keeper of Bestwood Park and forester of Thornley, and eleven other foresters, thirty-five woodwards, fourteen regarders, three verderers, or a total of sixty-five officers.

The position of forester was ever an honorable one. The forester in England was in those days, and on the Continent of Europe is still, a man of some importance and standing. About the center of Sherwood Forest, at Blidworth Church, is a monument or mural tablet to the memory of a local Elizabethan worthy, Thomas Leake, who was forest ranger of Blidworth district. Around the margin of the tablet are a number of curious hunting trophies, long-bows, cross-bows, horn, hounds, etc. The epitaph is interesting:

Here rests T. Leake, whose virtues were so well knowne
 In all these parts that this engraved stone
 Needs naught relate but his untimely end,
 Which was in single fight, whylst youth did lend
 His ayde to valor, hee wt. ease oerpast
 Many slyght dangers, greater than this last;
 But wilfulle fate in these things governs all,
 Hee towld out threescore years before his fall,
 Most of wh. tyme hee wasted in this wood
 Much of his wealth, and last of all his blood.

Febr. 4, 1608.

In many English churchyards may be found tombstones in the form of foresters' slabs, with carved thereon the symbol of the deceased's rank, whether master forester, verderer, woodward or regarder. Cox's book gives many illustrations of these slabs.³

Administration. There was on most forests a pretty well defined organization, with the forest divided into districts or compartments, each in charge of an officer. Thus Dartmoor Forest was divided into four quarters or wards or districts. These districts were known as North, South, East, and West, and accounts for each district were kept separate. For the years 1354-55 there are some interesting records of the business on three of the four districts of Dartmoor, as follows:

East district had 2,641 cattle and 198 horses grazing under permit. There were five permits to peat-cutters. The total receipts were \$165.05.

West district had 1,408 cattle and 37 horses, and 22 folds and 12 peat-cutters, with receipts of \$48.70.

North district carried 298 cattle and 163 horses, 14 folds and 31 peat-cutters.

Ralph Houle was the agister for Dartmoor Forest in 1370-71, and his accounts show some interesting statistical data—the Annual Statistical Report for Dartmoor Forest. For the East district this year the records show 2,762 cattle permitted on the forest and 1,762 outside, or under what we would call an "on and off permit." For the West district there were 952 cattle and 12 horses permitted, while there were 38 men who paid on folds and 13 who cut peat on the forest. These with \$3.97 paid for rents made the total receipts of \$47.41. Not a heavy revenue-producing forest, but when the disbursements are noted, the forest was apparently self-supporting. Among the disbursements for

³ These old foresters' slabs offer excellent suggestions for designs for book-plates for a forester.

the forest were \$15 of tithe, \$1.66 to the clerk who prepared the return, and the pay of \$3.33 for the two foresters—but they received an additional 12 cents a week bonus during the four weeks of deer-calving time. So there were accounts and cost keeping back in 1370!

SILVICULTURE.

Forest trees. The trees mentioned in early English forests records are oaks, referred to as quercus or robura (*Q. sessiaflora* and *pedunculata*, formerly *Q. robin*), sweet chestnut, lime or linden (*Tilia europaea*), *Acer campestre* (?), known as Arabilis frequently in earlier forest records (and towards the beginning of the Fourteenth Century called “mappil,” “mapul,” and “mapeles”). Beech was common, while elm was rare and of late occurrence, with other less important trees as ash, blackthorn, hornbeam, whitethorn, holly, hazel; the latter was very common, and was responsible for the “nut-geld” frequently appearing in the old records.

Forest statistics. A very general and severe gale or windstorm that occurred during the latter part of the year 1222 was the cause of furnishing probably the most correct list of the Royal Forests extant. This storm was so general that Henry III issued orders to forest officers not to interfere with the prostrate trees or branches until further orders, and to proceed at once to draw up a careful valuation of their worth. On January 30, 1223, the King instructed the sheriffs of all counties containing forests to place the money from the sale of such fallen timber and branches in some religious house, and with it a roll or report giving full particulars of the sales.

A careful survey or reconnaissance was made of the woods of Birkland and Billhagh (parts of Sherwood Forest) in 1609, which showed that there was a total of 21,009 oak trees in Birkland, and 28,900 trees in Billhagh, and that the trees were in general all past maturity. Quernmore Forest is described as having a circumference of six miles. Within this forest was Easton wood, of six acres, containing a stand of alder, hazel and whitethorn, 40 years old, worth \$2.25 per acre; also there were 100 saplings for timber trees, worth \$1.25 each. In another wood, called New Kent, were 40 dotard oaks, suitable for fire wood, worth 50 cents each. Dickson Carr Wood was said to be “sundry besett with aller (alder) of an evil growth,” and was to be cleared and planted to trees of a better kind.

Forest preservation. Henry VIII's fight with the Pope had a disastrous effect on the forests of England. As one result of this contro-

versy Henry dissolved the monasteries, and a large number of forests and parts of forests belonged to the monasteries. Upon their dissolution by Henry the forest lands of the monasteries passed either to the crown or into private hands, and here we see the old, old story of what happens to forests in private ownership. No sooner had these forests passed into private hands than the greater part of them was cleared. This aroused opposition, and in 1543 an act for the preservation of timber was passed, the preamble of which laid great stress on the decay of timber, the coming scarcity of timber for building of ships, houses, and for fire wood. This act provided some quite definite cutting rules and felling periods were established. In copse of underwood, felled at 24 years' growth, there were to be left 12 standards or "store oaks" per acre, or in default of oak, so many beech, elm or ash. When cut under a 14-year rotation, the ground was to be enclosed or protected for four years.

This same act provided that the cutting of trees on waste or common lands was to be punished by a fine of \$1.66. This act of Henry's was extended by Elizabeth to provide, among other things, that a person found cutting or spoiling any wood or underwood or standing trees, who being unable to pay the fine, should be whipped. Certain forest surveys made during Queen Elizabeth's time, such as those for Duffield Frith Forest, give full details as to forest, timber and undergrowth, enumerating every tree.

Timber sales. Sales of timber and cordwood were made from the forests from the earliest times. In 1346, the wood from the coppice near Canonpath was sold for \$86.81; there were 43 purchasers for this wood, the largest individual sale amounting to \$6.66. In old forest records there is mention of a "sealing axe," or marking axe, used for *blazoning* the timber to be felled.

Free use. Free use of timber, especially to religious orders, churches, and public buildings, played a most important part from the earliest times. From Sherwood Forest, in 1228, four oaks were given to William Avenal, described as waiting on the King of Scotland; two oaks to the leper colony at Chesterfield, six to the priory of Bligh, six to the canons of Newark, three to the priory of Thurgarton. The use to which the timber was to be placed was always specified in the grant; to religious houses the timber was usually to be used in the completion or repair of churches.

Sometimes this free use timber was cut timber; for example, in 1228, the King sent 20 beams from Sherwood to a distant church in Norfolk.

Timber trespass. Sometimes there was a trespass reported, which upon investigation would prove to be innocent, or that the alleged trespasser had a right to cut the timber. At a forest court held in 1267, the Abbot of Rufford was charged with having taken 483 oaks from Sherwood Forest, but the Abbot plead justification through the charter of Henry II and got away with it. An example of vert or timber trespass is reported, the damages or value of the wood being figured as follows: 3 beeches worth 75 cents, 2 oaks worth 50 cents; offender to pay in each case an additional fine (punitive damages) of \$3.

Boundaries. Various and extensive changes were made in the number and boundaries of the Royal Forests from reign to reign. William the Conqueror made heavy additions and extensions to the forests. There were many complaints made of the hardships caused by William's autocratic acts. King John, in 1215, was compelled by one of the clauses of the Magna Charta to eliminate or abolish all the great tracts which he had set aside during his reign. The Child King, Henry, was made to issue the Charta of the Forest in 1217, by which it was provided that the boundaries of all forests made by Henry II were to be carefully examined and that all but his own lands were to be eliminated. In 1240, the sheriff was directed to summon a jury to determine by actual examination on the ground the boundaries of Dartmoor Forest. The results of this examination still exist, with a quaint map of the forest.

Examinations of the boundaries of a forest were called "perambulations," and there were "perambulating knights," who laid out the forest as a rule. We read that in 1301 the Forest of Essex was covered by a boundary examination. In 1630 the boundaries were again laid down, which practically agreed with those of 1301. Four years later much indignation was aroused by the crown officials attempting to raise money by extending the area of Essex Forest. Failing in this, an attempt was made, also futile, to secure its disafforestation (or abolishment) and sale. This resulted in an act being passed during the first session of the Long Parliament to fix the boundaries, and a perambulation showed that the forest contained 60,000 acres. "Forest," we recall, in those days in England oftentimes included vast districts, which embraced woodlands, and wild wastes of moor, as well as patches of cultivated lands. Whole counties were taken into the forests, whereat there was much complaint by the people.

Many of the forests had their boundaries marked. Dartmoor Forest especially was well marked, with granite boundary and guide posts, of which at least thirty are standing today. Such stones almost always assumed the cross in shape.

Uses. The woods were used much as ours are today. Certain industries were allowed, under grant or permit. Iron smelters, surface coal mining, quarrying of stone, millstones and tombstones, and for lime and marl. Such industries were usually located as near the exterior boundaries of the forests as possible. Fees were charged for the use of the forest land. The charge for folds was 4 cents per fold; peat was charged for at 10 cents per peat digger.

Iron forges were fairly abundant in the forests. There was also considerable coal mining. In Dartmoor and Exmoor Forests there were particular regulations covering the securing of peat, while in other forests the quarrying of stone, burning of lime and digging of marl were allowed. Tanneries were not allowed, as the tanning of hides made an odor that was obnoxious to the deer! Dartmoor Forest received special use fees from water-mills, fairs, toll-tins, peat digging, rent of farm lands, etc.

Prescriptive rights. There arose certain prescriptive rights within the forests due to the use of certain forest lands or products which had been granted to certain individuals or communities through many years, which in time came to be regarded as fixed and permanent rights, and hereditary. In many cases the original grant plainly stated that the right was to an individual only for his life time. These rights covered hunting of certain kinds of game, use of specified amounts or kinds of timber or wood, or the use of the forage. A curious example occurred during the reign of Henry III, in 1231, when he granted to Mabel de Cantilupe for life the right to erect and operate an iron forge in Dean Forest. The following year this lady received a grant or right to use an oak on each of fifteen days she chose, every year, as long as she lived.

GRAZING

Each forest had its quota of live stock, allowed under a definite system of paid permits, and grazing seasons, with a graduated scale of fees. Stock was subject to the strict oversight and direction of the agisters. This stock belonged to the tenants within the forests or those living just outside. All forests were liable to have grazing suspended altogether or in part, if circumstances warranted it, which circum-

stances meant that, if the presence of the stock interfered with the deer, the live stock was excluded. On some forests no stock was allowed during the winter months, as all the forage was needed by the deer. Hogs were allowed during the mast, or as the old records call it, the pannage season. This season lasted from September 14 to November 18. The usual agistment or grazing fees for hogs was 2 cents per swine above a year old. The forest or local courts were usually kept busy during the autumn months in fining those who had unagisted hogs in trespass on the forests. In 1257 a survey of a portion of Windsor Forest showed that it had 156 hogs under permit, worth 50 cents each.

Cattle were allowed in practically all forests. From an early date it was customary to insist upon all forest cattle being branded for identification with the brand of the particular forest. Thus in accounts of 1321-22, of Needwood Forest, occurs an item of 6 cents paid for an iron for branding the cattle allowed on that forest. The duty of the reeves of the forest parishes was to mark the cattle entitled to graze on the grass lands within the forest. In the case of Essex Forest the mark or brand consisted of the letter E surrounded by a crown, or as it might be called on western ranges, "Crown E." Other brands for well-known forests were "Crooked Billett" and "Maypole" for Barking Forest; "Crown Lazy E" for Epping Forest; "Sawtooth H" for Chigwell Forest; "Pitchfork L" for Dagenham Forest.⁴ The marking or branding irons were usually eight inches in height. Many of these old branding irons are still in existence, and in Cox's book are given illustrations of many of these curious old irons.

Dartmoor Forest was the most conspicuous example of a vast forest district given up chiefly to the grazing of cattle. The accounts and court rolls from Edward III to James I give full details of the large number of cattle turned out in each of its four divisions or districts. As high as 5,000 head were carried and fees were 3 cents per head. This forest had 60,000 acres, and from the records it carried 5,000 head of cattle (and probably hogs and horses in addition), giving a carrying capacity of 12 acres per cow, besides being well stocked with deer. In handling the cattle there were annual drives, when the cattle were marked or branded, numbered and counted. Horses were allowed universally, especially brood mares. It was generally recognized that horses did more damage to the forest than cattle or sheep.

⁴Examples of a considerable number of cattle brands are given in "The Forest of Essex—its History, Laws, Administration and Ancient Customs," 4to. Vol. 1887. Also in Home's "Town of Pickering," 1905.

Grazing complaints. Sheep were allowed only on certain forests, and then only at certain periods in the history of those particular forests. At the Domesday survey there was a large number of sheep in the parishes embraced within the forest of Essex. The old Norman laws distinctly forbade sheep pasturing in forests without a special license or permit. The reason usually given for this restriction, as stated in a Seventeenth Century action at law, was because "of the dislike which the Redd and fallow Deare doe naturallie take to the sent and smelle of the sheepe; as also for that the sheepe do undereate the Deare and hurt and spoyle the coverte, and thereby prejudice and wrong Deare both in their feeding and layer." These statements were, however, flatly denied by the other side in this controversy, who said that "dayly experience proveth the contrary; and that it is an usual thing to see a deare and a sheepe feed together in one quillet of ground, even upon one mole-hill together." (National Forest officers will recognize a familiar ring to this!)

Grazing trespass. The agistment rolls of Dartmoor Forest in 1571-72, which had previously been confined to cattle and horses, include a considerable number of sheep, in flocks ranging from 10 to 300. The free-holders of Needwood Forest, in 1680, decided that sheep found pasturing in a forest were to be forfeited and \$3 a day per head was to be imposed. The old forest records have a curious classification of sheep: wethers (multones), ewes (oves or oves matrices), 2-year-olds (bidentes), hogs or male 1-year olds (hogastri), gimmers, female sheep from first to second shearing (jercie), and lambs.

The turning out of goats even in the wildest parts of a forest was unlawful, except in very restricted areas, under a special permit. By tainting the pasture they effectually drove out the deer. The Scottish law of the forest provided that if goats were found for the third time in a forest the forester was to hang one of them by the horns on a tree; while if a fourth time, he was to kill one and leave its entrails in the place, as a notice that a goat had been found in that spot. Certain stray goats found in the Forest of Mara, Cheshire, in 1271, were forfeited to the master forester. No fewer than 56 persons were arrested and brought before the court of Epping Forest in 1323-24 for keeping goats in the forest contrary to law. When Henry III was at Stamford, in 1229, he was waited on by a body of men from Kingscliff and surrounding townships, who complained bitterly that Hugh de Neville, the master forester of Rockingham Forest, and his rangers refused to permit them to allow their goats on the Forest of Cliff, according to

ancient custom, and that because of this they were unable to make a living for themselves and their families. The goats must have been of considerable number, and the King must have been moved by this heart-rending appeal, for he ordered that these goat-men be allowed to graze their animals in the open part of the forest and where they would do the least damage to the forest.

Overgrazing. In 1194, Giraldus Cambrensis wrote that in the Forest of the Peak that deer were so abundant that "they trampled both dogs and hunters to death in the impetuosity of their flight." By Henry VIII's time, however, the situation had changed to such an extent that the King decided to have an investigation made. In July, 1526, the King issued a commission to Sir Thomas Copayne and three others to inquire into the overstocking of "our Forest of the Peak more than was ever wont with numbers of capilles, bestes and shepe." It seems that the forest had been overgrazed to such an extent that there was no forage left for the deer. The commission was also to report on the carrying capacity of the forest, in cattle and sheep, and also make a census of the game in the forest at the time. The commission met and heard witnesses. One Hugh Fretham deposed and said that there were five herds of cattle and formerly there were only two; that the herds numbered 903 head; that there were 4,000 sheep and sixteen score horses. Three other witnesses said the same. The commission walked through the forest, reporting the deer seen, noted that the grass was much trampled and poor, and recommended that sheep be excluded from the forest, if the deer were to remain. And as true then as now, when the commission recommended the exclusion of sheep, there was a protest.

The Forest of the Peak again appears to have had trouble with the sheepmen later, in Queen Elizabeth's reign. Queen Bess decided to have another inspection, and have a thorough one, including a personnel inspection, as well as a grazing and range inspection. In June, 1561, about the beginning of the forester's usual field season, she sent out her inspectors, giving them detailed instructions, to wit: they were to report on the rights of pasturage for live stock within the forest, whether the foresters "do diligently use and keep their walkes about the said forest (in short, were they getting out in the field enough), whether they use any part of the fines raised at the swainmotes (forest courts) for their own purposes; what oxgangs they (the foresters) hold and what cattle they pasture; whether they use their own authority for excusing trespassers, and whether the pasturing of sheep is not very hurtful to the deer."

FIRE PROTECTION IN PORTUGAL,¹

BY THEODORE S. WOOLSEY, JR.

The basic preventative fire laws governing fires on or near State, communal, or private lands in Portugal provide that there shall be no fires within 200 yards of forest boundaries, no brush can be burned nor any fire set within forests; the penalties are \$100 to \$300 and under certain conditions there may be a prison sentence.

A typical example of State forest fire protection is found in the maritime forest of Leiria, a State forest of some 28,066 acres, about 15 miles long by 5 miles in width, lying between Oporto and Lisbon along the seacoast.

The fire protective system is as follows:

(1). Fire lines, *which are always kept cleared*, (a) 10 to 20 yards in width (east and west), (b) 3 to 5 yards in width (north and south) which divide the forest into 342 compartments with an average area of 82 acres.

(2). Four lookout stations, connected by telephone and all visible from one point, are supplied with an oriented map of the forest with alidade. The central station then locates the fire by triangulation. In the words of the official report:

"As soon as the watcher sees smoke or fire he directs his telescope to the point where it appears and forthwith informs the administrative headquarters by telephone that he has discovered smoke or fire at such and such a degree. The other observation towers, being questioned, answer in the same way, indicating the point or degree where they see the same fire, so that the administration, by drawing the different angles indicated obtains the exact point where they cross each other, thus showing the portion of the woods where the fire is burning."

This is of interest, since this practical use of triangulation in fire detection in Portugal probably antedates its use in the United States.

After a fire is discovered some of the methods are rather amusing.

(a) All stations hoist a red flag and blow horns—the fire signal to all workmen and guards.

¹Based on data secured by the American Ambassador at Lisbon from the Ministerio da Agricultura, July 17, 1919. The writer has been collecting data on fire protection for some years, and this note may be of interest.

(b) When a fire is reported, orders are given "to close the gates (of the forest) and permit no exit, as all hands must proceed to the fire." Church bells are rung outside the forest and fire fighters *from the outside* are paid for their services.

(c) "At a central point there are always a group of eight guards with the respective horses. Instead of a gun, a hoe or a scythe may be fastened in a leather bag (with a strap) to the saddle. These eight men being advised, march rapidly to the place pointed out to them, blowing an alarm-horn and calling on all other people they meet to join them, and one or two of them are sent to advise the laborers who are working nearest to the place where the fire is"

"*To ensure the presence of laborers* in the most dangerous season for fires, the forest service *reserves some cultivation work for the summer months*, so as to keep in various parts of the forest small groups of men that can be called upon at a moment's notice to help to put out the fire."

(d) Tool caches are kept at the various guards stations for distribution to fire fighters (hoes, scythes, and spades).

A PROPOSED STANDARDIZATION OF THE CHECKING OF VOLUME TABLES

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There is need for a better and more uniform practice in checking volume tables. In the past they have too often either been accepted unchallenged or have been tested in a rather perfunctory and inadequate way. As a result there is to-day a wide difference of opinion as to the value of many of even the most modern tables, and those who believe in the accuracy of any one of them can rarely support their opinion by satisfactory evidence.

Checking in the past has apparently been restricted in the main to the case where it is desired to use a volume table in some region other than that for which it was constructed. It has hence consisted in measuring a score or more trees in the new region and comparing their total volume as scaled with that read from the table for the same number of trees of corresponding sizes. Such a test has its value but it is both uncertain and inadequate, and it should be considered as investigating not the accuracy of the table itself but its applicability to a given stand.

Before we try to ascertain whether a volume table will accurately apply to the trees of an alien region we should inquire how well it measures the very trees on which it has been based. To borrow a simile from surveying, we should know the precision with which the base line has been determined before we calculate the accuracy of computed distances between far-off triangulated peaks. The first and fundamental checking which a volume table should receive is that against its own basic data.

The most obvious test of this nature is of course a comparison between the total actual scaled volume of all the trees from which the table has been prepared with that given by the table for the same number of trees of equal sizes. In making this test it should not be necessary to interpolate between the tabular values for fractions of inches in diameter or fractions of logs in height as there is every reason to expect satisfactory compensation of any errors resulting from an

omission of this precaution. The result of such a comparison (judging from my personal experience) should disclose an error of not to exceed 1 per cent if the table has been even moderately well prepared. If it proves to be more than this the desirability of repeating the work of constructing the table is strongly indicated. If much less it can be disregarded. Intermediate values should be used to correct the table. If the actual total volume of the trees, for instance, is 1 per cent more than that given by the table, all of the tabular values should be raised by that percentage.

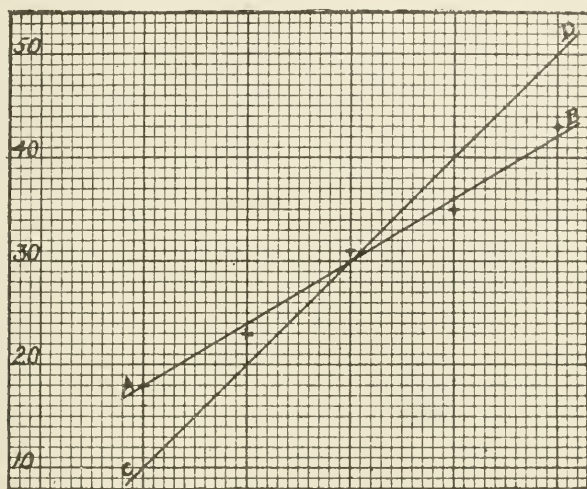


FIG. 1

This test, however, while necessary, is not sufficient. It is not enough to know that our volume table is accurate in the aggregate and we should demand also that it give as closely as possible a correct value for each individual tree. Let me illustrate the importance of this principle by a simplified example. The line C D in figure 1 will check as perfectly with the five points marked by the crosses in the aggregate as will the line A B, yet the latter is a far closer approximation to the true position. A comparison of aggregate values fails to bring to light the erroneous direction of C D, and permits absurd plus and minus errors to neutralize each other. The fairer comparison between these two lines consists in calculating the deviations of the individual points from each to see which gives the smaller total or average. In the following table, for instance, the agreement of the totals of the first

three columns appears to show that both A B and C D are satisfactory in their position, while columns 4 and 5 bring out the actual marked inferiority of C D.

Actual values of points	Values given by		Deviations or differences between points	
	CD	AB	CD	AB
18	10	18	8	0
23	20	24	3	1
31	30	30	1	1
35	40	36	5	1
43	50	42	7	1
Totals 150	150	150	24	4

This is merely a hypothetical case, but it indicates how the aggregate check, while essential, may be misleading if used alone. The optimum position of any curve is that which not only gives a negligible difference in the aggregate but also a minimum sum (or average) of all the deviations of its basic points therefrom.

This statement is of course not strictly accurate. By the theory of least squares the best possible fit of a given line or curve to empirical data is that which gives a minimum sum of the deviations *squared*. To square all the deviations, however, is laborious and may be an unnecessary refinement. These considerations open up the question of which of the commonly recognized "measures of dispersion"¹ should be employed in the case of volume tables. There are three which seem particularly promising, the probable error of the mean, the standard deviation, and the average deviation. The former is attractive in the implication of its name which loses, however, some of its significance when applied not to a simple arithmetical average but to an average curve of unknown equation. Its formula is relatively complicated and the resulting additional labor seems unjustified. The standard deviation (that is, the square root of the average squared deviation) is an accurate criterion as above indicated, but its computation is laborious and it is to be avoided if possible. The average deviation is far simpler and seems to be sufficiently accurate. It can be proven that the average deviation is a minimum when figured from a median value rather than from an arithmetical mean. In any case where median and arithmetical mean coincide it is, then, just as accurate as the standard deviation. As a matter of fact in the case of volume tables, there are strong indica-

¹ See such works as "An Introduction to the Theory of Statistics," by G. N. Yule, for a complete general discussion thereof.

tions that mean and median values differ in the long run by but a fraction of one per cent, and if this be true, the only drawback of the average deviation disappears.

If then the average deviation, being sufficiently correct and more easily computed, is accepted as the best measure of the accuracy of a volume table it remains to be decided how it should be computed. Several alternatives offer themselves. In the first place it must obviously be figured in percent and not (as in the foregoing table) in actual differences, as otherwise relatively important errors in small trees would have less weight than trivial errors in large. Secondly, it may be calculated either from the average values of each diameter-height-class (the results being properly weighted in accordance with the number of trees in each class) or it may be computed for individual trees. The use of the class averages will materially reduce the labor of computation, since they are usually worked out already in connection with the preparation of the table, but it seems nevertheless inadvisable. It will result in an artificially small average deviation and one which will depend on the accident of the grouping of the trees in the size classes. Of two volume tables, each based on the same number of trees, each of the same range of size, and each with the same average deviation by individual trees, that which has the greater concentration of tree measurements into a few classes is almost certain to have the smaller class-average deviation. This is because the class grouping permits some plus and minus errors to offset each other, which is contrary to the basic idea of the average deviation. There are cases, however, as where volume tables are made from taper curves, where no other procedure is practicable. Thirdly, it must be determined whether it is necessary to interpolate between the actual values of the table to take into account fractions of inches in diameter and fractions of logs in height. While the average deviation should obviously be reduced by this precaution, there is a great deal of work involved therein, and on the whole it seems unnecessary. Its neglect should affect different volume tables about equally regardless of the number of trees used or their distribution. There should be a small handicap in favor of the table which reads to every inch of diameter as compared with that which reads only to even inches, or to every half log of height instead of to every log, but this is a minor matter as compared to the great additional labor involved in interpolations.

The actual differences in two actual tests between these methods of calculating the average deviation are illustrated by the following table:

Volume table	Number of trees for which deviations were computed	Number of classes in which these trees were grouped	Average deviation of basic data from table in per cent.		
			Computed by diameter height classes interpolated	Computed by individual trees, not interpolated	Computed by individual trees, interpolated
A	72	3	1.5	9.0	7.5
B	73	9	1.0	10.9	9.3

The final column is the most accurate, but it will be seen that the next to the last tells about the same story, while the fourth column is misleading.

In conclusion, then, two tests should be made of every volume table against its fundamental data and the results thereof published with the table itself. The first of these is a comparison of the aggregate true volume of the basic trees with that given therefor by the table, and the second is a computation of the average deviation of the individual tree volumes from it. The former should result in a negligible difference (zero under favorable conditions) but the magnitudes to be expected in the latter cannot be definitely stated. The two tests just given suggest that values in the neighborhood of 10 per cent may be normal, but they are a meager basis for any general conclusion. The resulting average deviations would be used for the purpose of comparing different volume tables for the same species and (less closely) tables for different species of similar form. Hence as more and more tables were thus checked the results would become increasingly valuable. It is perhaps all too significant that in spite of the scores of volume tables that have been prepared during the past two decades one cannot yet state with confidence how closely individual trees should (or can) be measured on the average thereby.

If these two tests are adopted as standard and are hereafter uniformly and invariably made, not only will we have the satisfaction of knowing that, as it were, we have closed our traverses, but we will gradually build up knowledge which may guide us in deciding between existing tables and determining which of them need the revision. It will give us a quantitative line of attack on the old problem of the relative merits of local and general tables. We will have, too, a new light on testing the applicability of any table to a new region. If the same two tests be repeated for a group of alien trees and if both the aggregate difference is small and the average deviation agrees closely with that published for the table itself, one would have a well-founded confidence that the labor of preparing a new table was unnecessary.

THE HEIGHT AND DIAMETER BASIS FOR VOLUME TABLES

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THE BASIS FOR VOLUME TABLES

In spite of the many years during which volume tables have been in use in this country, there is still little uniformity of opinion as to the basis on which they should be constructed. It has come to be quite universally agreed that both height and diameter must be recognized as factors of volume, but the method of measuring the former is as yet not standardized and even the point of measurement of the latter may still be questioned. While it is possible that differences in present practice and opinion may be justified in different forest regions, it is more probable that some at least of these divergences are due to the personal preferences of the men responsible for volume table preparation and to the absence of rigorous investigative work.

THE DIAMETER MEASUREMENT

On the question of diameter there is less disagreement. Foresters generally accept the measurement at breast height as standard, although several other points of measurement are still occasionally advocated. Chief among these others is d.i.b. stump (the favorite of the professional cruisers of the old school), the obvious advantage of which is that it is a measurement free from the influence of bark thickness. In choosing between this basis¹ and the standard d.b.h. there are two points to be considered: (1) The ease and accuracy with which the measurements can be taken. (2) Their relative precision as an index of volume.

The first of these requirements is far better met by d.b.h. in the case of standing trees. Measurements of d.i.b. stump can be obtained with accuracy but not with ease, since the bark must be cut through. D.b.h. is then obviously preferable unless it can be shown that d.i.b. stump is the far better volume index.

¹ Diameter eye high (5.25 feet) has also been advocated by the writer for use with the Biltmore stick, but as a supplement to and not a substitute or d.b.h.

In comparing these two measurements from this point of view it is interesting to measure them against d.i.b. at 16 feet from the stump. This, while impracticable in the field on account of the difficulty of measuring diameters at that point, is of great theoretical interest because it is probably the optimum single diameter measurement as an index of board foot volume.

For this comparison thirty tree measurements of a single species and region were selected at random from a single merchantable height class, by the following plan: The first ten were chosen all in the same one-inch diameter class, and the average d.i.b. stump for them was found. The next ten trees were selected in the d.i.b. stump class thus indicated. In a similar way the last ten were chosen in the d.i.b. 16-foot class, which was found to be the average for the first twenty trees. The final result is a group which is essentially uniform in height and about equally uniform in diameter at each of the three points of measurement.

Since it has been found that frustum form factors vary but little with small changes of diameter and probably not at all with height, such factors for this group should be uniform in so far as they are determined by these two influences. Variations of frustum form factors among these thirty trees may then be taken as due chiefly to "form," or in other words, to the failure of the single diameter measurement to express volume.

Four species were investigated. The resulting probable errors, which appear in Table 1, should well express the relative accuracy as indices of the three points of diameter measurement.

TABLE 1.

Species	Probable errors ^a in value of frustum form factor obtained from single trees when diameter is measured		
	At breast height outside bark	On the stump inside bark	At 16 feet from stump inside bark
	Per cent	Per cent	Per cent
Sugar pine.....	9.4	11.8	5.1
Incense cedar.....	13.3	12.5	8.1
White fir.....	11.3	10.5	5.0
Western white pine.....	6.1	8.6	5.4
Average.....	10.0	10.9	5.9

^a Computed by least square approximation formulae $E = \frac{.8435 \approx v}{\sqrt{n(n-1)}}$

It will be seen that as was to be expected, d.i.b. 16 feet is decidedly superior. Between d.b.h. and d.i.b. stump there is little choice. It is evident that in some species the root swelling distorts the stump measurement more than the bark thickness distorts the d.b.h. measurements, and *vice versa*. For the four species examined the advantage is slightly in favor of the d.b.h. standard and, since that point is also more convenient, the belief of foresters in the d.b.h. seems justified.

THE HEIGHT MEASUREMENT

There is considerably more room for argument on the question of the point of height measurement. Three systems have ardent adherents among foresters, namely, total height, merchantable height to a fixed top cutting limit, and height as actually used by loggers. Neglecting, for the moment, purely practical considerations, let us examine the merits of the three from the standpoint of their relative accuracy as volume indices. Thirty trees of each species were chosen at random from a single 1-inch diameter class. Three volume-height curves based on total, merchantable, and used heights, respectively, were then drawn for the group. The actual volume of each tree was then divided by the corresponding volume given by each curve for an average tree of the same height and diameter. By this means the probable deviation of individual trees from each curve was computed.

TABLE 2.

Species	Probable deviation of the volumes of single trees from volume-height curve based on*		
	Merchantable height to fixed top cutting limit	Used height	Total height
	Per cent	Per cent	Per cent
Sugar pine.....	9.3	10.6	11.4
White fir.....	8.2	12.1	8.5
Incense cedar.....	(15.6) ^a	....	(17.6) ^a
Western white pine....	(7.3) ^a	....	(8.2) ^a
Average.....	5.7	11.3	10.0

^a Values not included.

The fixed top cutting limit is seen to be slightly but consistently superior, yet the differences are small and practical considerations again may determine our choice. For certain work, such as permanent sample plot measurements, it is of prime importance that the height measurement be taken by a method of great precision, so as to permit detection of small increases in height. Since it is difficult to be sure of the exact point at which to sight the hypsometer in measuring merchantable heights, the total height has been and probably will continue to be preferred for such work. For the occasional volume table expressed in cubic feet, also, this basis is almost forced upon us. In routine timber estimating, however, particularly in the very tall timber of the west coast and the Inland Empire, it is sometimes nearly impossible and often very difficult to see the extreme tip of the tree. The estimator often wants, moreover, in addition to his volume estimate, figures on the actual merchantable or used length of the trees, or the total number of logs in a stand, or the log run. Such figures are collected automatically where merchantable or used height tables are employed. For such cases, then, total height will not do, and it remains to be considered whether heights are to be measured to a fixed top cutting limit or to a limit varying with the logging practice of the region.

The case for the latter has been strongly presented by Chapman,² who uses two main arguments. He points out that since the importance of the top cutting limit is far greater from the standpoint of a height index than of a utilization index, surprisingly grave errors will result if a cruiser estimates heights to the used top and then applies a fixed top volume table. This, of course, works both ways, and only supports the theory of used top volume tables if his second contention is also true, namely, that there exists "a natural tendency of estimators . . . to tally to the point which represents used length."

One of the species mentioned by Chapman as being characteristically cut to a variable top is the western yellow pine. Some twelve volume tables of the modern type have been prepared by the Forest Service for this species. In five of these the fixed top cutting limit was adopted, while in the other seven a range was used as shown in the following table:

²"The Effect of Top Diameters in Construction and Application of Volume Tables Based on Log Lengths," by H. H. Chapman, *Proc. Soc. Amer. For.*, XI:2:221ff.

TABLE 3—*Top Cutting Limit in Inches of Western Yellow Pine Volume Tables.*

D. B. H.	Region to which Table applies						
	Bitterroot, Montana.	Western Montana, Butte, and Madera Co., Calif.	Blackfeet, Kootenai, Missoula, Montana.	Lassen, Plumas, Sequoia, Shasta, Stanislaus, and Trinity, Calif.	Klamath County, Oregon.	Blue Mountains, Oregon.	Black Hills, N. Dak.
10	6	10	6	7	..	6	6
12	7	10	6	8	6	6	7
14	7	11	6	8	7	6	8
16	7	11	7	8	7	7	8
18	8	12	7	8	7	7	9
20	8	12	7	9	7	7	11
22	8	13	8	9	7	7	12
24	8	14	8	9	8	7	13
26	9	14	9	10	8	8	..
28	9	15	10	10	8	8	..
30	9	16	11	10	9	9	..
32	10	17	12	10	9	9	..
34	10	17	14	11	9	10	..
36	..	18	13	11	10	11	..
38	..	19	17	11	10	11	..
40	..	20	18	11	11	12	..
42	..	21	..	11	11	13	..
44	..	21	..	12	12	..	..
46	..	22	..	12	13	..	..
48	..	23	..	12	13	..	..
50	..	..	..	12	14	..	..

NOTE.—Four other tables are to a fixed 8-inch, and one to a 6-inch top.

The variations in these figures are surprising and would not seem to indicate any great consistency in the ideas of what constitutes used length. Of course it might be argued that for different regions there would naturally be differences in form and hence in utilization, but the above table seems to indicate that some of the most extreme variations are in the same or similar regions. Compare, for example, the first three columns, or again the fourth and fifth. The following table gives the actual cutting practice of two adjacent logging operations in very similar timber on the east side of the Sierras, and that of the volume table used by the Forest Service for that region. The fourth column gives a forester's estimate of the merchantable limit made after falling, but in advance of marking or bucking, for the trees represented in column 3.

TABLE 4—*Top Cutting Limit in Inches.*

D. B. H. inches	Volume table	Operation A		Operation B, actual practice
		Actual practice	Estimated	
20-24	9	12	11.0	10
26-32	10	14	10.5	14
34-42	11	18	11.5	15
44-50	12	21	11.5	15

The discrepancies are striking. It is obvious that the top diameter cut in this region is a matter of the individual judgment of the operator and that the individual judgments of two operators may be far apart. It is also obvious that if the volume table is built according to one standard and the estimate made according to another, serious errors will result. Suppose, for instance, a cruiser had based his conception of what constituted a merchantable top on operation A and estimated heights accordingly, but computes his estimates by the standard district volume table. By the District 5 taper table for western yellow pine, it will be seen that a 46-inch 7-log tree would be measured as but 6 logs high. It would contain 4,600 feet board measure, but he would read from the table the volume of the shorter tree, or 4,200 feet board measure, an error of 9 per cent. If, on the other hand, a new volume table were constructed on operation A and were used by a cruiser whose ideas were fixed from observing operation B, the error would be in the opposite direction, and perhaps reduced, but still in the neighborhood of 6 per cent, a figure far too great to be accepted with complacency.

It was doubtless with this difficulty in mind that the makers of volume tables based on variable tops have appended a list of average top diameters as found. But this is of little value to the estimator. In the first place, the range is not the same for any two species, and it would be somewhat of a feat of memory to carry in mind the five sets of figures most necessary for use in the Sierras or the nine required in parts of the northern Rockies. Such figures are moreover often misleading. Chapman has pointed out that the used top limit tends to decrease with height within each diameter class. The rate of decrease seems to vary widely with the whim of the logger, and very great con-

fusion sometimes results. It was this fact which was found to be the cause of an apparently absurd contradiction in two Montana volume tables for western yellow pine. It appeared, for example, that in one locality a 30-inch, 8-log tree with an 8-inch top scaled 2,090 feet board measure, while only a few miles away a 30-inch, 8-log tree with an 11-inch top scaled but 1,740! As a matter of fact the 8 and 11 inch top limits noted in the tables were merely diameter class averages and were meaningless when applied to 8-log trees. The former was actually based on trees of a larger top than the latter for the size in question. It was finally found necessary to discard both tables and to prepare a new one based on a fixed top cutting limit, as the only alternative was to append to each a second table showing the average top d.i.b. for each height and diameter class, a result obviously impracticable for field work.

The foregoing instances indicate that

(1) While there is a tendency to deviate from a fixed top cutting limit in logging operations, yet there may be no definite standard of top utilization even for the same species in the same region.

(2) An attempt to adopt some one such standard for a volume table involves great difficulties in insuring that the cruiser estimates heights according to that standard; if he does not, his errors through such inconsistency will be far more serious than would at first appear. The point of height measurement is of more importance as a volume index than as a standard of utilization, and it follows, therefore, that a measurement that can be definitely and consistently made is of prime importance. The fixed top cutting limit is therefore preferable by far, even for such species as western yellow pine,⁴ while for others, such as western white pine or western larch, it already expresses existing practice as well.

It may be objected that when heights are measured to a fixed top cutting limit of, say, 8 inches, in a species which, in its larger diameters, is rarely used beyond the 12-inch point, a fictitious volume (and number of logs) is thereby tallied. This is doubtless true, but it is the

⁴Chandler's work on certain eastern hardwoods would seem to indicate that in some species that have no well-defined axis to the top an additional factor or factors must be added to the tables, and that height to neither fixed nor variable top with diameter will solve the problem unless taper and form are also recognized. (B. A. Chandler: "Study of Frustum Form Factors of Hard Maple and Yellow Birch." Bul. 210, Vt. Agr. Exp. Stat., Mar., 1918.)

lesser evil. It is an error, moreover, which is easily recognized and eliminated. A "cull" factor must be applied to the results of any volume table to take care not only of rot, but also of the loss through breakage, etc. It is a simple matter to increase this factor by the trifling amount (rarely over 1 or 2 per cent) necessary to allow for the unused top.

It may be objected that height measurements are seldom taken with precision in cruising and that the difference in height to the fixed and to the used top, being smaller than the accuracy of height measurement, may be ignored. The fallacy in this argument lies in its comparison of the compensating errors of ocular height estimates with the non-compensating error of a lower or higher point of measurement. Even a poor marksman wants to have his gun-sights properly adjusted.

THE FACTOR OF FORM OR TAPER

If it be accepted, then, that diameters should be measured at breast height and heights to a fixed top cutting limit, at least for the common type of volume table, one question still remains to be asked. Is a table based on diameter and height alone adequate, or must the third factor of taper or form be added? The answer is: "Not if we can help it," for there is no known method of calculating accurately this third factor which does not involve a determination both much more difficult and far less exact than those of height and diameter. And it is doubtful if very serious errors result from our present practice in the case of western conifers. An indication of the results of the neglect of this third factor is given by the figures of Tables 1 and 2. The probable variation of individual trees from group averages when form is neglected was in these cases from 6 to 15 per cent. These figures should be compared with the probable error in volume computation by the much discussed form-point method of Jonson. Petrini has shown⁵ that this amounts to 5.4 per cent for Norway spruce. The gain through estimating the form point of each tree is not sufficient to conclusively prove its desirability. On the basis of the probable errors calculated in Tables 1 and 2, it appears that the probable error (due to volume tables) of "forty" estimates will be under 1 per cent, even with scattered stands of but from 1 to 6 trees per acre.

⁵ Heddelanden fran Statens Skogsforsoksanstalt, p. 267, Hefte 15, 1918.

This is true, of course, only where the volume table is applicable to the stand. If this is not the case, far greater errors are likely to occur. The trees on which the above figures are based were (except in the case of western white pine) in each case from a wide range of conditions. They were collected from varying sites and include many different ages. They represent very fairly the sort of trees from which the Forest Service has been preparing district volume tables. But while significant, these figures are admittedly inconclusive. Other information is unfortunately meagre. Certain tables have been tested and found to apply within 1 or 2 per cent in aggregate measurements to practically the whole range of the species. In the case of other tables, which have failed to give good results, there has sometimes been reason to doubt whether the cause was not rather in the preparation of the table itself, that is, whether the table would not have failed to measure accurately even the very trees from which it was prepared. In other cases the discrepancies were undoubtedly due to the use of a different standard of top utilization.

It is through lack of foresight on the part of the profession that this ignorance still exists. Had a very little more care been put on volume table preparation, had basis and form been standardized, had every table made been checked against its basic data and the probable error or average deviation been computed, and had slightly fuller data been published in connection with each table on the range of site and age conditions included, we would probably long since have arrived, almost automatically, at some approximate standards of accuracy, and hence today have some better conception of what limitations of conditions must be observed to attain them.

CONCLUSION

In conclusion, it seems that for western conifers, at least, the proper program is to prepare volume table on the basis of d.b.h. and either total height or merchantable height to a fixed top cutting limit in accordance with the use to which they are to be put, omitting the addition of the third factor of form until it has been proved needed. With a little more attention to volume table preparation, the question of the necessity of complicating further our tables should, in a few years, answer itself.

REVIEWS

United States Forest Policy. By Dr. John Ise, Yale University Press, New Haven, Connecticut, 1920. Pp. 395.

Dr. Ise has given a real and enduring service to American forestry in his recent publication, "The United States Forest Policy." The history of the United States is fundamentally a history of rapid exploitation of immensely valuable natural resources. The exploitation of these resources has had not a little to do with American character and with American political and social institutions as well as with economic development. Our present wealth and "place in the sun" are primarily due to the possession of these great natural resources of which the forest is one of the most important and basic. The question of its conservation through wise use is, therefore, one of the most important questions before the American people. This question is even of far greater importance at this time than heretofore because most of us now see for the first time the end of wood supplies from our virgin stands at no distant future.

The aim of the author has been to throw light upon the great and pressing need for forest conservation. He does this by a careful and painstaking analysis of our forest policy and its historical development. The work appears to be done with reservation and accuracy and in the reviewer's opinion will prove a most valuable reference for the student and layman whenever facts and data relating to the laws and regulations under which forestry in this country has developed, are needed. The vast assemblage of facts relating to national and state forest laws, unsuccessful and successful attempts at constructive forest legislation and relating to forest associations and other organizations having directly or indirectly influenced our forest policy, is readily available through an excellent table of contents and the index which closes the volume.

Dr. Ise has approached his task as an economist and historian and without personal bias. He has recorded things as they have been and as they are, and he has left it to his readers to form their own judgments whether our forest policy has always moved forward along a path leading toward adequate future timber supplies and whether it is now a policy that the American public can look to with confidence. From the standpoint of historical development of our present policy the book leaves little to be desired.

Chapter one is a concise, though comprehensive history of our forests and the development of forestry prior to 1878. It discusses such topics as the early settlers and the forests, naval reserves, public indifference, early conservation sentiment, early interest in timber culture, tree planting by the railroads, the timber culture act, swamp land grants, and the preemption commutation, homestead and desert land laws, also public sale of timber land, railroad land grants, unfavorable legislation applying specifically to timber, and free timber, and the timber and stone acts. This chapter like all others, is replete with footnote references which add much to the value of the book for reference.

Chapter two covers the period from 1878 to 1891, a period of wholesale timber stealing from the national domain. This chapter deals in part with the evil effects of legislation enacted in the previous period and lax enforcement of the forest laws, the feeble efforts to protect the public timber, indirect encouragement of timber stealing and the increasing difficulties in the way of timber protection. A careful study of this chapter forces the conclusion that the utter disregard for the forests on the public domain, their reckless exploitation through fraud and their destruction by fire had not a little to do in stimulating public sentiment for national forest reserves, this sentiment finally culminating at the end of the period in the forest reserve act which is justly considered the greatest piece of constructive forest legislation in our entire history.

The following seven chapters deal for the most part with the acquirement and development of the National Forests and with the increased influence of the National Forest Service. The early hostility toward the National Forests is discussed at length and special emphasis is given to the "golden era" of forest conservation activity which begun in 1897. Emphasis is placed upon favorable results following from the transfer of the National Forests to the Department of Agriculture. It is but natural that antagonism should develop from withdrawing so much of the public domain from settlement for the creation of National Forests. This antagonism gradually developed into intense anti-conservation activity in the West and in the national Congress, which culminated in the Ballinger-Pinchot controversy in the Taft administration. This entire matter which is of so much interest to American foresters is presented in a most thorough and admirable manner. From the study of these chapters it is easy to appreciate the disasters that might have overtaken our National Forests were our public officials in charge of them less resolute and determined.

The analysis of the activity of the Forest Service, though brief, outlines its great constructive work during the first two decades of the present century. In reading these chapters one cannot help experiencing a feeling of pride in a public service which has done so well and accomplished so much against harrowing criticism and opposition on the part of would-be profiteers as well as many Congressmen.

The final three chapters deal with the results of our forest policy and with a rational policy for the future. Emphasis is placed upon the consolidation of privately owned timber in few hands, the power of large holders, timber speculation and the so-called lumber monopoly. Special attention is also given to price fixing, the instability of the lumber market and the lumber industry and timber speculation. Attention is also given to the waste of timber and the failure to reforest denuded lands.

Taken as a whole the history and results of the United States forest policy as characterized and discussed by Dr. Ise at considerable detail leaves a bitter taste in the mouth of patriotic American citizenship. As the author says, "it is a distressing story of reckless and wasteful destruction of magnificent forests and a flagrant and notorious theft of valuable lands." What the nation has been able to save from her former abundance is due to the development of the idea of forest conservation and the momentum which it received during the 80's and 90's and which flowered in the conservation movement of the early years of the present century under the leadership of Gifford Pinchot.

The least satisfactory part of the entire volume is the meager two pages given to a national policy for the future. The story of our past as characterized by an economist and historian does not lead to a clearly stated forest policy which gives reasonable assurance of adequate timber supplies for our future needs. Although the need for a careful classification of all public lands is recognized, that only those that are fit for agriculture be alienated, the author apparently does not recognize the essential need of a forest policy under which all absolute forest land both public and private be brought under sustained yield. In the reviewer's opinion a forest policy adequate for our future needs must recognize a great increase in publicly owned forest or the organization of privately owned timber land for sustained yield. The former is only possible through a policy of extensive purchase by the public of timber land now privately owned and the latter by a plan of cooperation between the public and the private owner or possible mandatory regulations which will make sustained yield attainable without undue financial loss to the private owner.

J. W. T.

RECENT PUBLICATIONS

BOTANY AND ZOOLOGY

Pennsylvania Trees. By J. S. Illick. Revised Edition. Bulletin 11, Pennsylvania Department of Forestry. Harrisburg, Penna. 1919. Pp. 235.

MENSURATION, FINANCE, AND MANAGEMENT

Making Woodlands Profitable in the Southern States. By W. R. Mattoon. Farmers' Bulletin 1071. U. S. Department of Agriculture. Washington, D. C. 1919. Pp. 38.

POLITICS, EDUCATION, AND LEGISLATION

Report of the Forester for the Year Ended June 30, 1919. By H. S. Graves. U. S. Department of Agriculture. Washington, D. C. 1919. Pp. 34.

A Policy of Forestry for the Nation. By H. S. Graves. Circular 148, U. S. Department of Agriculture. Washington, D. C. 1919. Pp. 11.

Report of the U. S. Bureau of Entomology for the Year Ending June 30, 1919. Department of Agriculture. Washington, D. C. 1919. Pp. 27.

Twenty-second Annual Report of the Massachusetts Forestry Association. Including Special Report on the National Parks and National Forests Tour. Bulletin 126. 1919.

Annual Report for the Year Ending June 30, 1918, Department of Conservation and Development of the State of New Jersey. Trenton, N. J. 1919. Pp. 109.

Ninth Annual Report of Conservation Commission of the State of New York for the Year 1919. Albany, N. Y. 1920. Pp. 255.

Second Annual Report of the State Forester. By J. H. Foster. Bulletin 8, Department of Forestry, Agricultural and Mechanical College of Texas. College Station, Texas. 1917. Pp. 7.

Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1918. Manila, P. I. 1919. Pp. 83.

Annual Progress Report upon State Forest Administration in South Australia for the Year 1918-19. By W. Gill. Woods and Forests Department. Adelaide, S. A. 1919. Pp. 12.

Conservation: The Form or the Substance—Which? By Wilson Compton. Bureau of Economics. National Lumber Manufacturers' Association. Chicago, Ill. 1919. Pp. 24.

Economic Aspects of State Forests. Address by Wilson Compton, Secretary-Manager, before the Tri-State Forestry Conference (Ohio, Indiana, Illinois), at Indianapolis, Ind., October 22, 1919. National Lumber Manufacturers' Association, Bureau of Economics. Chicago, Ill. 1920. Pp. 19.

Suggestions for a National Forest Policy, with Especial Reference to the Pulp and Paper Industry. Report of Committee on Forest Conservation, the American Paper and Pulp Association at Business Conference, November 4, 1919.

SILVICULTURE, PROTECTION, AND EXTENSION

A Study of the Rots of Western White Pine. By J. R. Weir. Bulletin 799, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1919. Pp. 24.

Fourteenth Annual Report of the Coeur d'Alene Timber Protective Association. Coeur d'Alene, Idaho. 1919. Pp. 11.

Report of the Spruce Budworm. By M. W. Blackman. Maine Forestry Department, in co-operation with the Forestry Department, University of Maine, and the Maine Agricultural Experiment Station. 1919. Pp. 10.

Report of the White Pine Weevil. By M. W. Blackman. Maine Forestry Department, in co-operation with the Forestry Department, University of Maine, and the Maine Agricultural Experiment Station. 1919. Pp. 12.

Report on White Pine Blister Rust Control, 1919. By S. B. Detwiler. Published by the American Plant Pest Committee, Boston, Mass. Pp. 12.

Forest Fire Protection in East Texas. By L. Wyman, L. G. Jones and E. O. Siecke. Bulletin 9, Department of Forestry, Agricultural and Mechanical College of Texas. College Station, Texas. 1919. Pp. 14.

Forest Fires in Canada, 1917. Bulletin 68, Dominion Forestry Branch. Ottawa, Canada. 1919. Pp. 24.

UTILIZATION, MARKET, AND TECHNOLOGY

Quality and Value of Important Types of Peat Material. By A. P. Dachnowski. Bulletin No. 802, U. S. Department of Agriculture. Contribution from the Bureau of Plant Industry. Washington, D. C. 1919. Pp. 40.

Wood as Emergency Fuel. By J. H. Foster and F. H. Millen. Bulletin of the Agricultural and Mechanical College of Texas. Third Series, Vol. 4, No. 2. College Station, Texas. 1918. Pp. 3.

MISCELLANEOUS

Vacation Days in Colorado's National Forests. Circular, U. S. Department of Agriculture. Contribution from the Forest Service, Washington, D. C. 1919. Pp. 60.

Adirondack Highways. By C. R. Pettis. Recreation Circular 3. Conservation Commission. Albany, N. Y. 1919. Pp. 30.

St. Lawrence Reservation. By A. B. Strough. Recreation Circular 5. Conservation Commission. Albany, N. Y. 1919. Pp. 22.

Adirondack Canoe Routes. By H. G. Howard. Recreation Circular 7. Conservation Commission. Albany, N. Y. 1920. Pp. 22.

PERIODICAL LITERATURE

SILVICULTURE, PROTECTION, AND EXTENSION

*The Red
Rot*

Discusses red rot (*Trametes radiciperda*) on spruce near Schongau. This is a morainal region, with the tertiary sub-layer exposed along canyons, and with considerable areas of high moor between the moraines. The morainal deposits weather into a fresh, sandy loam, which with the heavy precipitation (1,250 mm.) is very favorable to forest growth. Where the loam is shallow or cut off by clay at a depth of 10 cm., moors are likely to form. The best timber is on the "hard" soils, while that on the "soft" (moor) soils is not as good. Spruce comprises 95 per cent of the stand, associated with beech and fir on the "hard" soils and with alder and birch on the "soft" soils. Mayer disagrees with Sauer's theory that red rot was favored by removal of the beech from the spruce stands, and that pole-stands now heavily infested were formerly healthy stands of spruce. He says the rot was always present, but not noticed until wood prices became high, and besides there is as much beech in the mixture as there ever was, or even more. Figures show more rot on sites where beech or other hardwood species are present, than in pure spruce stands. Statistics of rot per cent in conifers cut during six years (1912-1917) show a gradual decrease in per cent of rot from 14.4 in 1912 to 10.6 in 1917, due probably to the institution in 1908 of a system of thinnings which take out old defective trees as well as young trees. Then, too, the practice of bringing the wood out to roadsides in winter eliminates much of the rot injury which formerly occurred. In general, per cent of rot increases with decrease in soil-moisture; the average for "hard" soils was 12.7 per cent, and for "soft" soils 7.1 per cent. Contrary to Sauer's assertion, boggy sites are not especially liable to infection, nor do the figures show rot to be any worse in the first rotation on reforested land which had been used for agriculture. Spruce roots develop very differently on "soft" and on "hard" soils. On moors, the root mass is barely 20 cm. thick and covers 30 square meters or more, with numerous root masses at the periphery, called "paws" (tatzen) by wood-choppers. These are not due to the presence of beech, since they are common where there is no beech, but are caused by soil conditions. Neither is the dying off of the older roots of spruce retarded by the

presence of beech. Whether *Trametes* is at all responsible is a question. As far as known, the fungus never directly kills a spruce, even though it may have been infected for many years. Red rot probably seldom attacks perfectly healthy trees, but may get in through root injuries caused by wind-stresses, hoofs of cattle, and especially by hauling out logs during the growing season. Red rot causes loss, not by killing the tree or retarding growth, but because of the degrading of the infected wood. In 1917, out of a total cut of about 10,500 cubic meters, 1,120 was more or less rotten and sold for less than half of what it would have brought if sound. It will hardly be wise to try to check rot by introducing beech in spruce stands until certain that that will help, because to do so will involve heavy thinnings and a considerably lower yield per acre.

W. N. S.

Mayer, Karl. *Die Rotfäule*. Forstwiss. Centralbl. 41: 121-127; 185-193. 1919

*Forest Fires
In France*

M. G. Raymond reviews the heavy fire losses in the forest of l'Ésterel (Var) where in two days most of the forest was burned (July 27-28, 1918) during a drought and high winds. Other fires in pine forests in the same region broke out during the same week. Raymond raises the question whether the fires did not originate from having dry branches rubbed against each other after being blown by the wind. The tinder dry brush, needles, and resin would form good kindling and possibly "the phenomena of generating electricity by rubbing" . . . (as in the Sahara) might partly account for the large number of fires which started simultaneously and which could not have been due to incendiarism. Such a theory might be studied on National Forests in Southern California.

T. S. W., JR.

Revue des Eaux et Forêts, 1919, pp. 157-159.

*Influence of
Size of Trees
on Results of
Thinning*

Two sample plots in a stand of fir about 60 years old and averaging respectively 9.3 and 11.2 centimeters in diameter, were thinned in 1886 and again in 1899. Careful records of growth which were maintained until 1911 showed that the increased growth resulting from the thinnings was uniformly greater both in diameter and volume in the smaller trees. This difference is probably due to the fact that the smaller trees were

younger and therefore more vigorous than the larger trees. While further investigation is needed to determine how generally applicable are the results of this experiment, two conclusions may be drawn from it: (1) that sample plots to study the effect of different degrees of thinning should be composed of trees of as nearly as possible the same size; (2) that as a rule thinnings may be profitably undertaken at an earlier age than is now customary.

S. T. D.

Mer, E. *Influence de la dimension des arbres sur l'efficacité des éclaircies*. Rev. Eaux et Forêts. 57: 141-146; 165-175. 1919.

UTILIZATION, MARKET, AND TECHNOLOGY

Generally the vertical elements of woods are
Ripple Marks interlaced in such a way that they do not lie in
In Wood definite horizontal layers or strata, but in a considerable number of the dicotyledons some or all

of the elements are found to be so arranged. This regular storied arrangement gives the appearance of the "ripple marks" seen most clearly on the tangential section as fine parallel lines more or less wavy or rippled and running in a direction cross-wise of the fibers or horizontally in the tree. Professor Record presents in this article a summary of his own study of this peculiar feature of the structure of woods, and also a review of the investigations of other scientists.

A remarkable fact noted in the article is that there is no close correlation between this peculiarity of wood structure and the various types of floral organization which serve as the basis of the botanical classification. There appears to be some relation, on the other hand, between this storied arrangement and other features of the wood structure. It is of interest to note that with few exceptions (*Aesculus*, *Cercis*, *Cytisus*, *Diospyros*, and *Tilia*) the woods are of tropical or subtropical origin.

This storied arrangement may be only that of the vessel segments or of one of the other elements alone as tracheids or parenchyma cells, or even of some one characteristic, such as the pitting near the ends of the fibers and in other cases it may be that all of the elements are so arranged. Sometimes a secondary or intermediate striation is produced by the shorter parenchyma cells forming two to four layers to each one layer of vessel segments.

The lines are frequently more easily seen by unaided eye than under the microscope, since the accumulative effect is lost at the high

magnification. The ripple marks are nevertheless very fine and may easily be overlooked, for there may be from 45 such lines or striations per inch of length in some species to as many as 280 in others. These ripple marks are often sufficiently characteristic to be used for identifying the species. Nearly every wood showing 125 to 190 lines per inch belongs to the Leguminosae, which family contains the great majority of the woods having this striation, and the investigated woods of Zygophyllaceae have considerably more than 200, mostly 250. This fact is of value in distinguishing true lignum vitae from its various substitutes.

Ordinarily the wood fibers are much longer than the vessel segments or the height of the tiers. The fact that the fibers are so interlaced prevents wood having this storied structure from being weak in the planes of the tiers.

The medullary rays are frequently also in horizontal layers. When this is the case the rays occupy an intermediate position, the height of the tiers (distance between the lines being considerably greater than the height of the rays. Some rays, however, may cover two or three stories in height especially in woods which have two sizes of rays, as in *Cercis*. Where the rays are in perfect seriation, a cross section between two tiers may miss them completely, or may show rayless gaps if the plane of section does not exactly parallel the plane of the ray seriation.

The storied arrangement occurring in the wood is also present in the secondary phloem.

Professor Record has painstakingly marked out a comprehensive table giving the characteristics of all the elements in this respect, the degree of visibility, and the number of tiers per inch for twenty-one families and some 220 species of wood.

H. D. T.

"Storied or Tier-Like Structure of Certain Dicotyledonous Woods." Samuel J. Record (Contribution No. 4 from Yale School of Forestry). Bull. Torrey Bot. Club, July, 1919, pp. 253-273.

<i>Tapping Corsican Pine</i>	De Lapasse has written at length on the results of tapping Corsican pine in Corsica, and also on the relative results of the shelterwood and selection systems. Tapping of this species was practiced from 1856 to 1872, and the production was greatest between 1862 and 1867 because of the demand for turpentine during the American
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Civil War. In 1865, 139,000 trees were being tapped and at least one-fifth the number were being tapped to death. The results of this tapping proved conclusively that the turpentine and other extracts were of a higher quality than from the maritime pine in France proper, and the yield amounted to $1\frac{1}{2}$ kilograms per tree per year.

From the financial standpoint the operations were successful, but the results from the silviculture standpoint were not satisfactory. It damaged the quality of the saw timber, increased the fire danger, decreased growth and increased damage from fungus. Therefore, the U. S. Forest Service should proceed with caution in developing turpentine operations in western yellow pine.

Another interesting point brought out by De Lapasse is in regard to the best system of management for the Corsican pine, a conclusion which has a direct bearing on the management of western yellow pine in the United States. To-day the treatment applied is selection or group selection following the failure of the shelterwood system. Formerly the rotations were 120, 160 and 180 years at most, whereas to-day the rotations adopted are 300 to 360 years. The adoption of short rotations impoverished the forests and in many cases resulted in a suspension of fellings.

The shelterwood system was abandoned because the resulting even aged stands presented an extreme fire risk and resulted in great loss. According to De Lapasse:

"It was in 1886 that the first working plan for selection forests was decreed in Corsica. . . . Since then almost every old working plan for regular high forests has been revised and replaced by the selection system, a selection system by groups. The cultural advantage of the selection system over the shelterwood system in a country where one must always count upon fires, is in leaving standing (over the whole extent of the forest, mature trees which are seed producers and because of the thickness of their bark, can resist fire without suffering too much damage. Young trees killed by fire can thus be replaced at any stage of the life of the forest by nature alone. This consideration has been the determining factor in Corsica for completely abandoning (and for all species) the treatment in regular high forests."

The lesson taught by the results of forestry in Corsica cannot be overlooked, and those who advocate tapping western yellow pine for resin, especially in Arizona and New Mexico, where the climatic conditions are unfavorable, and those who advocate the shelterwood system for western yellow pine where there is great risk of fire, would do well to heed the lesson from Corsica.

T. S. W., JR.

*Walnut from
British India*

Kham describes at length the manufacture of rifle butts for the Ishapore Rifle Factory, and shows clearly that these butts can be supplied from Indian forests. On account of the shortage of black walnut in the United States, this is of interest to walnut manufacturers, and inquiries should be addressed to the Forest Economist, Dehra Dun, British India.

T. S. W., JR.

Indian Forester. Vol. 45, pp. 440-444.

POLITICS, EDUCATION, AND LEGISLATION

*Forest
Policy*

In these days of keen interest in matters of forest policy a lengthy article on this subject by a recognized English authority is of more than passing interest to American foresters.

The author, R. L. Robinson, deals with the subject in three parts: (a) The pre-war development of English forest policy. (b) The war and forestry. (c) Attempts to ascertain the guiding principles now struggling to gain expression in reshaping English forest policy.

As an explanation of the deplorable condition of forestry in Great Britain at the outbreak of the war the author ventures the statement that the Anglo-Saxon race is not instinctively a nation of foresters. It is a rather severe arraignment for an English forester when he states "It is an undeniable fact that the Anglo-Saxon race is not instinctively a race of foresters in the modern sense," and to offer this as an explanation of the progress of forestry in English speaking nations as contrasted with that of Continental Europe. The reviewer believes that differences in economic condition and industrial development have quite as much or more to do with the shaping of forest policy than racial traits. Is it not possible that the democratic institutions which hitherto have been most characteristic of Anglo-Saxons lend themselves less successfully to forest conservation? Were Great Britain an inland nation like Germany instead of a seafaring people with ships on every sea would racial traits have been effective in checking forestry development?

Of English speaking races the author credits the United States as perhaps the foremost advanced. He points to the Imperial Forest Service of India as the only bright spot in the British Empire so far as forestry is concerned.

It is quite evident from this article that the early policy pursued by Great Britain as well as her colonies was the ruthless employment of

the axe and saw. The story of forest devastation in Great Britain has been much the same as in the United States with the only difference that it began much earlier and has been carried much farther. As early as 1543 fears began to develop in England as to the supply of timber for home consumption. The period from this date to 1880 when attention was drawn to the possibility of utilizing uncultivated lands to better advantage for forestry than for agriculture can scarcely be described as effective in the development of a government forest policy.

Even after 1880 down to the outbreak of the war Great Britain depended more and more upon imports for her forest products. It appears that during the second half of the nineteenth century and the first decade of the twentieth there was a steady decrease in the area of forests in Great Britain. In Ireland alone the recent annual decrease has been placed at one thousand acres.

The outbreak of the war found Great Britain with an almost negligible forest resource and chiefly dependent on shipping for her forest supplies. Her annual bill for these imports was nearly one hundred and fifty million dollars. The advent of the submarine campaign showed Great Britain for the first time the economic insecurity of placing sole dependence upon imports for essential forest products. This had almost immediate effect from the forest policy point of view, and soon the country came to recognize the fundamental fact that forests are sources of wealth, that timber is a necessity for commercial development and consequently all risk of interruption in supply must if possible be avoided. This recognition has been accompanied by corresponding legislative activity in the realm of forest policy. It is appreciated, however, that even as yet guiding principles are struggling for expression.

Nearly four years ago in the midst of war a forestry reconstruction sub-committee was set up. A year later this sub-committee presented its report. This report is a comprehensive summary of the forestry situation in Great Britain and embodies certain definite recommendations. It is interesting to American foresters and others who are now discussing the re-shaping of our own forest policy that the English committee recognizes the inviolability of private forest property and did not recommend mandatory laws governing the control and regulation of such property. This committee placed its dependence upon increasing the area of public forests through purchase, public control through leasing and cooperation and financial assistance in making the

management of private forests and afforestation possible without serious financial loss to the owner. A specific forestry fund of three million four hundred twenty-five thousand pounds was recommended to finance the undertaking for the first ten years.

Although the report of the sub-committee called for radical changes and large appropriations it was accepted by the War Cabinet in November, 1918, and awaiting legislation the interim forest authority was set up to prepare the way for the permanent authority.

The forestry act which came into force September last followed very closely the recommendations of the forestry sub-committee. A commission of eight members was created by proper authority and equipped with wide powers for "promoting afforestation and the production and supply of timber and for purposes in connection therewith." It is interesting to note that the powers of the commission give it authority to purchase or lease any land suitable for afforestation, sell or let superfluous land, purchase and sell standing timber, make advances by way of loan and grant for afforestation, manage or supervise woods, establish and aid woodland industries, collect forest statistics, promote forestry education, experiment and research, and make inquiries for securing an adequate supply of timber in the United Kingdom and in the Dominions. It would appear from this that the activities of this committee are only limited by the funds appropriated.

The expenses of the commission are to be defrayed from a forestry fund into which will be paid three and one-half million pounds during the first ten years after April 1, 1919.

To an outsider it seems reasonably certain that the recent radical change in English forest policy will result in a land classification and the setting aside of extensive areas (absolute forest land) on which timber products will take precedence of other forms of soil utilization. There is also reason to believe there will be instituted a system of forest finance which will relieve the necessity for hand-to-mouth measures in forest management.

There are many things worth studying and analyzing in the recent re-shaping of the English forest policy. Are we not more certain to reach our goal of forest renewal through the recognition of the inviolability of private forest property, the recognition of the necessity for cooperation and financial assistance on the part of the public and the acceptance of mandatory laws only as the last resort?

J. W. T.

R. L. Robinson. *Forest Policy*. Quarterly Journal of Forestry, Volume XIV, April, 1920, pp. 82-95.

*British
Forestry Act,
1919*

The British Forestry act, which went into effect in the fall of 1919, "promises a good beginning, and will lay the foundation of a real and assured and established industry of the State."

This act was made possible by the shortage of timber during the Great War which forced the British Commons to realize that England had to depend on wood transported by water, a supply that might be largely cut off by the future development of submarine warfare. Therefore a home supply of timber had to be grown; this had the added advantage of giving employment to ex-soldiers and keeping them *on the land* away from congested labor centers. A digest of the act is as follows:

"(1) To appoint eight Forestry Commissioners, two have special knowledge and experience of forestry in Scotland and one at least to have a scientific and technical knowledge of forestry. Not more than three Commissioners to be paid, their combined salaries not to exceed £4,500 per year (normally \$21,915). The term of office of a Commissioner to be five years. On a casual vacancy occurring the vacancy to be filled *pro tem.* by a person appointed by the King. Commissioners to be eligible for reappointment. One of the unpaid Commissioners to be a member of Parliament.

"(2) The Commissioners to appoint such paid officers and servants as they think necessary, under Treasury sanction.

"(3) The powers and duties of the Boards of Agriculture for England, Scotland, and Ireland in relation to forestry to be transferred to the Commissioners, unless otherwise mutually agreed. The Commissioners to have power to purchase or take on lease and hold any land required for afforestation; to sell or let land unsuitable, or exchange it for other land that is more suitable; to purchase standing timber, sell, or otherwise dispose of timber belonging to them, to make advances by way of grant or loan to persons in respect of afforestation; to undertake the management or supervision on agreed terms, or give assistance or advice in relation to the planting or management of any woods or forests belonging to any persons; to establish or assist woodland industries; to collect and publish statistics and information relating to forestry; to make inquiries for the purpose of securing an adequate supply of timber in the United Kingdom.

"(4) The Commissioners to have power, on notice being given to an occupier of land, to destroy rabbits, hares, or vermin likely to damage trees or tree plants and to recover the cost incurred from the occupier.

"(5) Three Assistant Commissioners, one for England and Wales, one for Scotland, and one for Ireland to be appointed, at salaries to be determined by the Treasury.

"(6) Consultative committees for England, Scotland, Ireland, and Wales respectively to be established by Order in Council, to advise and assist the Commissioners. These committees to consist of persons having practical experience relating to forestry, woodcraft, and woodland industries; representatives of labor, of county councils, of forestry societies, and of woodland owners.

"(7) If unable to acquire land by agreement on reasonable terms, compulsory powers to be obtained from the Development Commissioners, but no land to be acquired compulsorily which forms part of any park, demense, garden, or pleasure ground, part of a home farm, or has been acquired for a public undertaking. Common land, if compulsorily acquired, to be held provisionally until confirmed by Parliament, except other land of at least the same area and certified as suitable by the Board of Agriculture be given in exchange. Facilities for the haulage of timber to be afforded, on order if necessary, the amount of rent or way-leave to be assessed by an arbitrator appointed by the Surveyors' Institution.

"(8) Salaries and all expenses to be defrayed out of the forestry fund, the amount of which is fixed for the first ten years, from April first this year at £3,500,000 (normally \$17,045,000), plus all sums received in respect of the sale of land or timber.

"(9) Authorized persons may enter on and survey any land for the purpose of ascertaining whether it is suitable for afforestation, or to inspect timber thereon, or for any other purpose in the performance of the duties of the Commissioners under the Act."

This is truly a beginning of real forestry in England, and it is unfortunate that a more generous appropriation was not received.

T. S. W., JR.

Indian Forester. 45: 681-683. 1919.

*The Wage
Agitation*

Following the Revolution, the introduction of the eight-hour day has been accompanied by insistent demands for higher wages in all branches of industry, which have finally gone far beyond the level justified by the increased cost of living. The expectation that with the return of millions of soldiers wages would come down has not

been fulfilled, but rather the opposite. The unemployment allotments have resulted in demoralization of the workers, who prefer to congregate in the cities and do nothing (there were 170,000 unemployed men in Berlin in January, 1919) than to work at agriculture or forestry in the rural districts, where there is a great shortage of laborers. The eight-hour day is not suited to either of these industries, because of the irregular nature of the work. Particularly in forestry is the piece-work system desirable, since it allows the peasant to work in close proximity to his dwelling, at times which suit his convenience and do not interfere with his work on his farm. The Government plans to take steps to educate the workers to realize that unduly high wages will have most serious results on the working classes themselves. In case of forest laborers this will be accomplished through the workmen's councils, which are to be chosen in each Oberforsterei by the year-long employees. High wages in forest industries will result in high wood prices, which will react on many other industries. The great housing shortage is not being met by new building because of high cost of labor and material. A workman's three or four room house which could be built for 4,500 marks and rented for 300 marks per annum before the war now costs at least 12,000 marks and rents for 900 marks. Because of higher cost of mine timbers, coal costs more, and the high price and shortage of coal has brought fuelwood to two or three times its pre-war price. All of this affects the working classes more than anyone else.

W. N. S.

Eberts. *Die Lohnbewegung in forstlichen Betrieben*. Forstwiss. Centralbl. 41: 201-210. 1919.

*Details of
Forestry Program
in England*

The forestation and betterment of 1,770,000 acres (within a period of 80 years) in the British Isles, which now appears to be assured, is justified by the economic and military needs of the nation. In the words of the Ministry of Recon-

struction: "It was known we were paying not only for foreign wood product, but also for foreign labor in fellings, in conversion, in manufactures, and in transportation. . . . The capital is already invested, and the business should result in regular, even if small, dividends. . . . The submarine depredations and the scarcity of shipping gradually cut us off . . . urgent repairs had to be post-

poned. . . . The end of the war will find us with our small area of woodlands (one-tenth acre per head against one-half acre per head in Germany and France) not only depleted, but devastated. . . . On the other hand, the Central Powers will find themselves in possession of the greater part of the forest wealth of Europe. . . . The war has shown that forestry is a key industry. . . . For war emergencies 1,770,000 acres of soft woods and 100,000 acres of hard woods are estimated as necessary, with 80-year rotations."

The land to be acquired will not only yield a necessary raw product, but will supply employment in the country, during the non-agricultural season, to 3,000 men and later 15,000 men at the least estimate.

The source of the land is as follows: Fifty thousand acres will be purchased, 100,000 leased (at 5 per cent on land value, or \$15 per acre), 25,000 on profit-sharing, 25,000 "dealt with by local authorities and private persons," and 50,000 to be replanted—a total of 250,000 acres during the first 10 years. There will be "compulsory acquisition" where necessary, but "no compulsion is proposed as regards replanting, provided the owner can *show that the denuded area is being used to as good or better advantage than it formerly was.*" The work will be gradually extended year after year. The 10-year scheme calls for an expenditure of about 14 million dollars; the returns are estimated at 3.5 to 4.2 per cent on \$15 land and 3.2 to 3.8 per cent on \$30 land. The per acre cost for the first 250,000 acres (10-year scheme) is as follows:

	<i>Per acre</i>
Afforestation charges	\$55.65
Research .....	.58
Education .....	.87
Forest industries .....	.49
Overhead staff	88
<hr/>	
Total.....	\$58.38

Probably the costs will prove to have been under-estimated and the net returns of 3.2 to 4.2 per cent over-estimated when the final balance sheet is drawn.

T. S. W., JR.

Commercial Forestry. Ministry of Reconstruction, 1919, pp. 1-16.

MISCELLANEOUS

Staddle notebooks should always be preserved since they often contain much information of the greatest value, particularly when they cover two or three rotations. The only difficulty in using them lies in the fact that the classifications used, which should always be clearly noted in the notebooks themselves, have varied from time to time. This is particularly serious when the staddle has not been regarded as limited to seedlings of the same age as the coppice, but as including all seedlings of a given size irrespective of their age. This practice, which is now becoming common, is open to serious objection, since it frequently leads to inability on the part of forest officers to determine to which rotation a given tree belongs. The result is that when it is necessary to choose between retaining a young standard of the same rotation as the coppice and another of the previous rotation, the latter is usually chosen in spite of the fact that its future growth will be decidedly less.

S. T. D.

H. de la Hamelinaye. *De l'utilité et de la tenue des calepins de balivage*. Rev. Eaux et Forêts. 57:200-201. 1919.

EDITORIAL COMMENT

THE LUMBER CONGRESS

The recent Lumber Congress held in Chicago was of more than usual interest to foresters.

Many of the sessions were devoted to discussions of the movement for a national forest policy, and the interest shown in this subject from various different angles was rather intense. The discussions were characterized by a feeling of uneasiness, a feeling that something should be done—even if the lumbermen had to do it themselves. The advisability of taking some sort of action within the industry itself cropped out more than once in such remarks, for example, as “every good lumberman admits that steps must be taken that have not been taken.” A veiled intimation that lumbermen themselves were quite able to handle the situation in their own way might be discerned in the statement that “we are not going to lay down any general forest plan for the whole country—or let anybody else do it.” Voluntary local effort would solve the problem.

The flag, the constitution, property rights, and individual initiative were invoked and approved so frequently as to lead the uninformed to believe that foresters, instead of planning to safeguard the public interest, were scheming to do away with all these things. The spirit of Speaker Sweet held the chair.

Aside from frequent scolding, labor was mentioned once, mildly, and in passing. Not only waste in trees should be considered; the human element must be borne in mind.

The principal plans for preventing forest devastation were briefly summarized by Mr. Allen. He dismissed the plan of the Pinchot Committee from serious consideration because he believed it too radical to command attention anywhere; it sought to impose the impossible, was unjust, unconstitutional and extreme. The program of the American Pulp and Paper Association was kindly censured because it, as well as the Pinchot report, “passed the buck to the public.” The Forest Service plan was referred to (somewhat dubiously) as “the best known and least understood plan of all,” and as a plan from which the element of Federal supervision had almost disappeared. Mr. Allen expressed himself very strongly to the effect that lumbermen must cooperate in some plan, and gave warning that a reform in the treat-

ment of forest lands could not be stalled off much longer, for the public would insist upon it. It was taken for granted, apparently, that the public would be glad to entrust the solution of the problem to the very industry which is injuring public interests. The supposition involves sublime confidence in the credulity of the people of the United States.

It was strongly intimated that there was probably need for some manner of regulation from outside the lumber industry when the majority of forest owners wanted it, for otherwise the majority would be left unprotected against the backward fellows. Such an intimation is extremely significant.

The Western Forestry and Conservation Association introduced a forest program which had been approved by its directors. Lack of space prohibits comment upon it here, although we shall be glad to review it in a later issue.

F. E. O.

COMPULSORY VERSUS VOLUNTARY FORESTRY PRACTICE

I should like to call attention to what I consider may be a fallacy in Dr. Wilson Compton's article, "The Need for Understanding," printed in the *JOURNAL OF FORESTRY*, March, 1920.

Dr. Compton makes a special point that compulsory private enterprise will not secure results which voluntary private enterprise fails to do. Probably in general this is very true if the conditions are otherwise entirely equal. So far as I know, however, none of the programs submitted by foresters contemplate leaving the conditions entirely equal when the attempt is made to compel a stoppage of forest devastation; on the contrary, all these plans contemplate greater assistance to the private owner and, to a considerable degree, a lessening of what has in the past been a destructive competition between forest industries. I think when these conditions concerning private enterprise in forestry are changed for the better, there is every reason to believe that private enterprise will be more profitable, and therefore be possible, where in the past it was unprofitable and, therefore, impossible.

The changes wrought in forest industry, as contemplated by the Pinchot Committee for example, will unquestionably involve holding down the cutting in each organized economic forest unit to an amount such as it can produce continuously under forest management. While it would be unwise to cut off supplies from any existing mill, even if

over-cutting should result, action of this nature would hereafter automatically limit the development of saw mills and other forest industries in any given forest unit to what the unit would continuously furnish raw material for. It is very clear that this will result in two things from the standpoint of forest industry. In the first place, it will stop the depreciation of saw mills and all other plants due to exhaustion of raw material, leaving only wear and tear and obsolescence as the chief depreciating factors. It will also result in a lessening competition in forest industry which will tend to do away with the destructive competition of the past. These two items of saving to the industry will, in my judgment, contribute much more to its returns than the small cost entailed by forestry will deduct from the returns.

This is, however, not the only help private forest industry can receive from public action. The mere forbidding of certain practices in the forest will remove the competition of those who have been most ruthless in their cutting methods. It will save industry, as E. T. Allen says, from competition of the "backward fellow."

Then again, assuming that certain costs were placed on the industry by public action, it is clear that in general the incidence would be almost universally the same as in the case of a tax. Such costs are always passed on without difficulty to the consumer, so that in this way mandatory private enterprise may profitably do what voluntary enterprise does not, because at the beginning so few voluntarily conserve the forests.

B. P. K.

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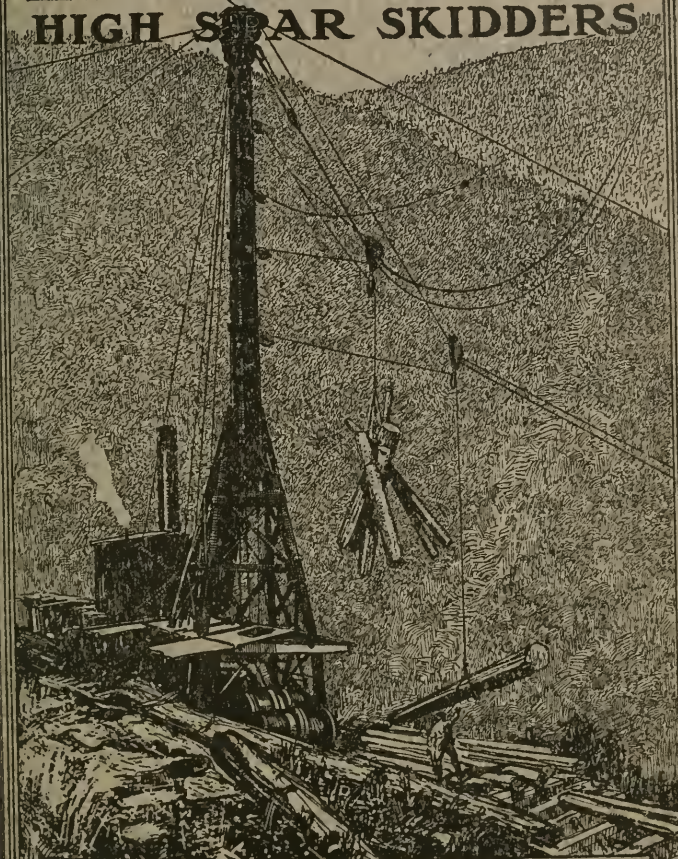
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REPORT OF THE COMMITTEE ON THE RESULTS OF THE REFERENDUM BALLOT ON THE SOCIETY'S PLAN FOR A NATIONAL FOREST POLICY

August 18, 1920.

PRESIDENT, SOCIETY OF AMERICAN FORESTERS:

Your Committee, composed of the undersigned, appointed to count and analyze the votes on the ballot for a proposed national forest policy, as outlined in the report of the Committee for the Application of Forestry of the Society of American Foresters, submits the following report:

A total of 166 ballots was received. Many ballots contained blanks, however, so that no one point was voted upon by the entire 166. The complete tabulated vote is shown on the accompanying ballot form.

The policy adopted by the Committee in counting the ballots was to register only the clear intent of the voter. Of the total number of votes received, 21 were straight complete affirmative ballots. All the others were divided between simple affirmative and negative answers, or contained numerous qualifications, explanations, and interpretations. The majority of these, however, were merely explanatory of the personal views of the voter and the construction which he placed upon the different sections of the ballot. No votes were counted as either "yes" or "no" if they did not clearly favor or oppose the principle involved in the section.

Some objections were raised to the wording of the ballot. These objections are typified in the resolutions passed by the New England section of the Society at Keene, New Hampshire, on July 24. The resolutions follow:

"WHEREAS, The ballot which has been submitted to the members of the Society of American Foresters on the report of the Committee for the Application of Forestry was not so formulated as to permit an expression of opinion on the report as a whole; and whereas by the exclusion of all reference to the minority report the members were prevented from expressing a preference between the principles and methods advocated by the majority and minority reports, respectively; *Therefore*, Be it resolved by the New England Section that the ballot as prepared has failed to meet the requirements of the vote passed at the annual meeting of the Society, and it is recommended by this section that a supplementary ballot be immediately issued that will permit a direct expression of opinion on the following three points:

"1. Is the principle of regulation of private property to prevent the destruction of the productivity of forest land approved?

"2. Is the principle that the enforcement of said regulatory measures to be placed in the hands of the Federal Government as advocated by the majority report of the Committee approved?

"3. As a substitute for the principle of direct Federal control, is the principle preferred that the immediate determination and enforcement of such regulatory measures to be under the authority of the State Governments with the co-operation of the Federal Government in the form of inspection, technical advice, and financial aid as advised in the minority report?"

The facts are as follows: At the annual meeting of the Society, held in New York on January 14, 1920, it was moved that a referendum vote on the report of the Committee for the Application of Forestry be taken clause by clause. The ballot was prepared accordingly, the substance of each clause being printed on the ballot itself. Before the ballot was printed, Mr. Olmsted, representing the Committee, discussed the form with Colonel Greeley and the ballot as presented was mutually agreed upon. Provision was not made for balloting on Professor Toumey's so-called minority report, for the simple reason that he signed the majority report and made no minority report. Even in case Professor Toumey had submitted a minority report it would not have been voted upon, for the instructions given the Secretary at the annual meeting called for a referendum vote on the Committee's report. To have made special provision for the voters to express their preference for or against the "Toumey Reservations" would have been just as inappropriate as to have made special provision for a vote upon the Forester's program of forestry, which also varies from the Committee's report.

The final question was added at the suggestion of the Forest Service as affording a common ground upon which all might agree, and its

wording was approved by Colonel Greeley before it was placed on the ballot. This question was, in a few instances, misinterpreted. Perhaps a clearer statement would have been as follows:

"Without committing yourself as to methods or machinery, do you favor the prevention of forest devastation on privately owned commercial timberlands by the enactment and enforcement of effective and fair legislation?"

It was apparent, however, that the great majority of those voting understood the question in that light.

The function of the present Committee is limited to a count and analysis of the balloting. In order to make clear the basis upon which we have proceeded the foregoing explanation has been necessary. It is realized that an individual might well vote affirmatively upon a number of points without being in agreement with the plan as a whole. The majority of the voters preferred to express their approval or disapproval of the individual items, in some cases explaining the basis upon which such decision was reached.

In several cases, however, it was feared that the transmission of such a ballot might be construed as an endorsement of the report as a whole. Consequently, several individual letters were received explaining a refusal to vote by the prepared ballot. There were eight such cases. In practically every case the author expressed his approval of a progressive forestry program, but disapproved of the plan as a whole. Obviously, it was impossible to include these eight cases in tabulating the returns on the detailed voting. In view of their failure to differentiate the points upon which they are in agreement or disagreement with the proposed plan, the Committee felt that it could only treat those members as not voting, but should report the existence of such a group.

All the clauses of the "Proposed Plan" were carried by substantial majorities, the closest vote being on Clause 7, which recommends National control. This clause carried, 94 to 61. Aside from the enforcement clauses, all of the clauses under "Suggested Legislation" were favorably acted upon with one exception. This exception is the clause calling for periodical reports from lumber manufacturers on production, orders, shipments, etc., which was voted down, 74 to 70. There was much divergence of opinion as to the advisability of creating a Commission, and the vote upon this was close, 82 to 76. Many of those voting "No" were in favor of placing the work in the hands of

one man rather than with a Commission. It is of interest, perhaps, to note that a large majority favored the clause sanctioning the co-operative combination of lumber manufacturers under certain conditions, and that a large majority favored giving the Secretary of Agriculture authority to carry on operations on the National Forests. The clause suggesting the creation of councils of lumber employers and employees carried by a vote of 80 to 66.

As to the enforcing clauses, a substantial majority voted unfavorably on requiring a Federal license and on the application of an income tax, the other two enforcing clauses receiving favorable majority votes.

The Committee trusts that the following points will be clearly understood by all members:

First: The Committee did not determine what should be voted upon. This was decided by the members at the annual meeting.

Second: The form of ballot was necessarily governed by the same decision. The report of the Committee for the Application of Forestry was to be voted upon clause by clause; consequently, the various questions were merely substantial quotations of the essential points in that report.

Third: It was the function of this Committee to report and interpret the results of a count of the ballots received. It has not attempted to predict what the result would have been had the vote been upon some other forestry program. No doubt such a forecast will be made by each member to his own entire satisfaction.

It is worth noting, perhaps, that this is the first time the Society of American Foresters has, as a body, expressed itself in favor of legislation for the perpetuation of forests.

The tabulated ballot is given in the attached table.

E. A. SHERMAN,
F. E. OLMSTED,
PAUL D. KELLETER,
Committee.

THE BALLOT IN DETAIL

THE PROPOSED PLAN

(A). A forest policy for the United States should be based upon the following *fundamental principles*:

1. PROSPERITY IN PEACE AND SAFETY IN WAR REQUIRE A GENEROUS AND UNFAILING SUPPLY OF FOREST PRODUCTS.

2. THE NATIONAL TIMBER SUPPLY MUST BE MADE SECURE—

(a) By forbidding the devastation of private forest lands and by promoting the conditions necessary to keep these lands permanently productive; and

(b) By the production of forest crops on public forests owned and operated by communities, States, and the Nation.

3. THE TRANSFORMATION OF PRODUCTIVE FORESTS INTO IDLE WASTES IMPOVERISHES THE NATION, DAMAGES THE INDIVIDUAL, IS WHOLLY NEEDLESS, AND MUST BE STOPPED.

4. UNLESS AND UNTIL LANDS CAN BE MORE PROFITABLY EMPLOYED FOR OTHER PURPOSES THEY SHOULD BE USED TO PRODUCE FOREST CROPS.

5. THE OWNERSHIP OF FOREST LAND CARRIES WITH IT A SPECIAL OBLIGATION NOT TO INJURE THE PUBLIC.

6. THE SECURE AND STEADY OPERATION OF THE LUMBER INDUSTRY IS OF VITAL CONCERN TO THE PUBLIC. To this end—

(a) The Government should always be fully informed on the chief facts relating to the business condition of the lumber industry.

(b) Machinery should be created for the interchange of views and the adjustment of differences arising between labor, management, and the public.

(c) The Government should be empowered to control lumber production in times of economic stress.

7. THE LUMBER INDUSTRY BEING NATION-WIDE, UNIFORM AND ADEQUATE CONTROL OVER IT MUST BE NATIONAL.

8. NATIONAL LEGISLATION TO PREVENT FOREST DEVASTATION SHOULD HAVE THREE OBJECTS:

(a) Such public control over private forest lands and only such as may be necessary to prevent the continued devastation of forests, and insure the continuous production of forest crops on lands which would otherwise be idle.

RESULT OF THE REFERENDUM BALLOT

585

	Follows (5 voting) Yes No	Seniors (145 voting) Yes No	Members (166 voting) Yes No	Total (166 votes) Yes No
1.	5 ..	136 ..	16 ..	157 ..
2. (a)	5 ..	117 23	12 4	134 27
2. (b)	5 ..	132 5	16 ..	153 5
3.	5 ..	125 12	13 2	143 14
4	5 ..	130 8	16 ..	151 8
5.	5 ..	104 36	14 2	123 38
6. (a)	4 ..	114 21	14 2	132 23
6. (b)	4 ..	89 42	10 4	103 46
6. (c)	3 1	82 49	14 2	99 52
7.	3 1	81 54	10 6	94 61
8. (a)	3 1	89 44	12 3	104 48

(b) Such public control and only such as may be necessary to place forest industries on a stable basis in harmony with public interests.

(c) The transfer of control back to the forest industries as soon as they become able and willing to assume responsibility for respecting the public interests, the Government retaining a supervisory function with full authority to renew its control at any time if the public interest so demands.

9. THE NATIONAL, STATE AND COMMUNITY FORESTS SHOULD BE MAINTAINED AND LARGELY INCREASED.

(NOTE.—The foregoing principles, as their application is here recommended, do not apply and are not intended to apply to farm woodlots.)

SUGGESTED LEGISLATION

(B). National legislation in furtherance of the proposed plan should include the enactment of a Federal law:

1. Creating a Commission, to consist of the Secretary of Agriculture, the Secretary of Labor, and the Chairman of the Federal Trade Commission, with the duty of making such rules, regulations, and decisions for the administration of the law as may be necessary, the Secretary of Agriculture to be Chairman of the Commission and the execution of the law to rest with the Forest Service under his direction.

2. Authorizing the Commission:

(a) To establish regional administrative organizations to coincide with the principal forest regions of the country, such organizations to be in charge of regional foresters to whom the Secretary of Agriculture, through the Forester, would delegate such authority as may be necessary for the prompt execution of the law in accord with local conditions and needs. The regional foresters would be authorized to explain the requirements of the law and regulations and to secure compliance or report non-compliance with them. Representatives of the Federal Trade Commission and the Department of Labor would be assigned to the several forest regions as might become necessary to co-operate in the administration of the law.

	F. Hows (5 voting) Ycs No		Seniors (145 voting) Ycs No		Members (16 voting) Ycs No		Total (166 votes) Ycs No	
8. (b)	3	1	82	44	12	4	97	49
8. (c)	3	1	79	40	16	5	92	46
9.	4	..	128	4	15	..	147	4
1.	3	2	69	68	10	6	82	76
2. (a)	3	1	67	61	10	5	80	67

RESULT OF THE REFERENDUM BALLOT

(b) To fix standards and promulgate rules to prevent the devastation and provide for the perpetuation of forest growth and the production of forest crops on privately owned timberlands operated for commercial purposes; but the Commission should not enforce such rules and standards upon farm woodlots nor upon other areas which in its judgment may be exempted with safety to the public interests.

The standards should relate to principles and general methods only, the greatest possible elasticity being allowed in their application to varying local forest conditions. The object of standardization should be to put an end to forest devastation, and to place the lumber industry on a uniform basis throughout the country as a whole. The object of local regulation should be to provide for forest protection and perpetuation in a manner fitted to local forest requirements.

(c) To require standardized accounting systems; periodical reports on production, orders, shipments, sales, distribution, stocks on hand, costs of production, and returns; and a special account of the increased costs, if any, of regulated over unregulated logging, showing also the direct and indirect gains under regulation. The Federal Trade Commission would assign such field agents to this work as might be necessary to obtain accurate results.

(d) To withdraw is supervision and make only such occasional inspections as may be necessary, whenever an organized forest unit proves itself capable of taking direct charge of the work of forest protection and perpetuation in its forests and gives assurance that the standards attained will be continued.

The Government would retain power to renew its supervision in case the public welfare so demanded.

(e) To control production whenever such action is necessary for the public good in times of economic stress.

(f) To sanction the co-operative combination of lumber manufacturers for all purposes resulting in economies in production and marketing whenever, in the judgment of the Commission, such co-operative combination will promote the public interest.

(g) To acquire for the United States the title or control of forest lands, both timbered and cut-over—

1. By purchase of the entire fee or of surface rights.
2. By a system of long-time leases.

2. (b)	3	1	68	56	12	4	83	61
2. (c)	3	1	57	68	10	5	70	74
2. (d)	3	1	62	62	10	5	75	68
2. (e)	3	1	70	56	12	4	85	61
2. (f)	3	1	87	39	11	4	101	44
2. (g ¹)	4	..	111	18	15	1	130	19
2. (g ²)	4	..	77	51	7	8	88	59

	Fellows (5 voting) Yes No	Seniors (145 voting) Yes No	Members (16 voting) Yes No	Total (166 votes) Yes No
3. By designating general areas within which title to all forest lands should pass to the Government by condemnation upon the completion of logging operations. (Compensation under the above methods should be made either from funds appropriated or from the sale of long-term serial bonds.)				
4. By gift.				
5. By defraying the additional expenses of regulated logging as a means of acquiring title or control.				
6. By the issuance of certificates receivable in payment for National Forest timber, ripe and approved for cutting, to be cut under National Forest rules and regulations, such certificates to be used for the purchase of the title to land (entire fee or surface) and timber privately owned within or adjacent to National Forests, values to be established by Government appraisal. Since lands of the United States are not taxable, the Commission should compensate the counties for losses in taxation caused by the transfer of title to the Nation.				
(b) To co-operate with the several States—				
1. For the protection of forests against fire and other enemies and for largely increased financial assistance to the States from the National Government for that purpose, under definite standards of efficiency.				
2. For promoting the purchase or acquisition of private forest lands by the Nation, the States, or by communities.				
3. For a uniform system of State forest taxation aimed at the best use of the land. Such legislation might include both measures for deferred taxation on standing timber and the placing of a sur-tax on forest land not protected and managed in substantial conformity with the national and State laws and with the standards and regulations promulgated by the Commission or by corresponding State authority.				
3. Authorizing the Secretary of Agriculture to carry on such operations on the National Forests as may be necessary to harvest and market forest products.				

4. Authorizing the establishment of adequate forest insurance agencies. These would be important factors in stabilizing the industry and would tend to bring about more thorough-going protection against fire.

5. Authorizing the creation of a National Forest Loan Board and Forest Loan Banks. This would enable the lumber industry to borrow on more equitable terms than at present, thus materially decreasing carrying charges.

6. Granting official recognition to regional and national councils of lumber employers and employees, chosen respectively by the operators and the workmen; and to joint regional and joint national councils of the regional and national employers and employees councils combined; or creating equivalent agencies under conditions and regulations promulgated by the Commission.

Among the functions of these councils would be to consider and adjust matter as wage rates, overtime, hours of employment, leaves, housing, board, insurance, and the participation of employees in matters relating to conditions of employment, and other questions between and concerning the relations of employers and employees to each other.

7. Providing, with appropriate penalties, for the enforcement of the law:

(a) By preventing the cutting or removal of forest products from commercial forest lands contrary to the provisions of the law, the standards, and regulations; and or

(b) By requiring a Federal license, to be obtained by concerns engaged in interstate commerce, without which forest products may not be cut or removed from commercial forest lands; and/or

(c) By preventing the cutting or removal of forest products from commercial forest lands on the watershed of any navigable stream contrary to the provisions of the law, standards, and regulations; and/or

(d) By means of a tax on the incomes of those who cut or remove forest products from commercial forest lands in violation of the law, standards, and regulations, or on the lumber thus cut.

FINAL QUESTION—

Regardless of method or machinery, do you favor the prevention of forest devastation on privately owned commercial timber lands by the enactment and enforcement of effective and fair legislation?

4.	5	..	115	15	14	1	134	16
5.	5	..	102	22	14	1	121	23
6.	4	1	67	59	9	6	80	66
7. (a)	3	2	75	51	11	5	89	58
7. (b)	2	2	53	67	9	7	64	76
7. (c)	3	2	70	60	11	5	84	67
7. (d)	3	2	44	78	9	7	56	87
	5	..	127	9	13	2	145	11

RELATION OF RESEARCH TO FOREST MANAGEMENT¹

BY HOWARD F. WEISS

C. F. Burgess Laboratories, Madison, Wis.

Broadly speaking, the object of research is to increase knowledge. Without increased knowledge there can be no progress. Therefore, it is fair to state that research is the foundation of progress. If you do not believe in research you will not believe in progress. I think it is the failure to appreciate this welded relationship that is causing certain forms of human activity to lag so far behind others.

However, the object of this paper is not to criticise the lumber industry. It is to point out the relation of research to forest management. This is a hard job because we have had little or no forest management in this country, only forest exploitation.

Without wishing to be unduly critical or pessimistic, it is my belief that we will continue to have forest exploitation so long as it is possible to buy stumpage for less than the cost of growing it. If this position is correct, then the way to bring about forest management is to give to stumpage a value greater than the cost of growing it.

There are two ways in which this might be accomplished. The first is to cut, burn down, kill with disease or otherwise destroy our forests. Then the demand for stumpage will be so much greater than the supply that it will pay to grow trees, and undoubtedly forest management will be practiced. From all indications we are pursuing this policy at present quite vigorously. This policy is aiding the practice of forest management, but it is also annihilating one of our great national resources and robbing our nation of its wealth. In this program research plays little or no part.

The second method of bringing about the practice of forest management is to create such a demand for the products of the forest that the price received for these products will more than equal the cost of producing them. In such a program research can play a most prominent part. If this proposal is accepted research can then be made a direct aid to forest management. I will elaborate on this proposal and amplify it later.

¹ Read before the Madison Section of the Society of American Foresters, May 10, 1920.

In an audience like this I assume there are several who will not agree with my position, namely, that we will have forest exploitation and not management so long as it is possible to buy stumpage for less than the cost of growing it, and second, that the two solutions I have proposed are the only ways in which to bring about the practice of forestry.

I will admit of a third solution, namely, for the Government to take over our forests and to manage them.

We cannot blame the men who have invested their money in forests for cutting them down as they are now doing, however much we may deplore this condition. They are forced to do so under pressure of economic struggle for existence. If they are to be blamed the public is equally guilty. So far as the Government taking over the forests is concerned, I believe such action would be contrary to our theory of Government, which is to encourage individual initiative and to guarantee freedom of action. Besides, why should not the Government take over our coal mines and oil resources which are even more vital to our welfare than our forest resources? When coal and oil are consumed they are gone forever. Forests can be reproduced. I question, therefore, whether Government ownership is a practical solution at least in our generation.

We will now consider the second proposal, since it is this proposal which is the main subject of this paper. This proposal is that we should create such a demand for the products of the forest that the price received for them will more than equal the cost of producing them. I think you will agree with me in part, in that, if this could be done, it would pay to grow trees, and if it would pay to grow trees, forest management will be readily accepted. Furthermore, a program of this kind would meet with little criticism since it is not radical, it does not encourage forest devastation, and it does not bring up the debatable question of Government ownership. Perhaps the most valid criticism against it is that it is not "practical" and is academic.

I believe such criticism is not strictly fair, because the problem is a most difficult one and has never been seriously attacked. Furthermore, it can not be solved by research alone. Research must have the support, morally and financially, of those able to give it moral and financial support. Right here lies a real difficulty which accounts for so much failure and discouragement. There are very few men of means who are sufficiently interested in forest research to want to give it their financial aid. Lumbermen prefer to let the Government do it.

I know of no other great American manufacturing industry that takes this attitude. Research, of any kind, is pioneering, it is risky, positive results cannot be guaranteed. Hence few men are willing to take the necessary risk. However, such men gain nothing, and only hurt their own interests by belittling research work, by laughing at it, or by humiliating it; yet are not all these a common attitude of mind?

On the other hand, research workers gain nothing by censuring and lambasting the men of financial strength who do not show what research workers consider to be the proper attitude toward research work. Research men are inclined to be narrow, their sense of proportion is often badly warped, and their stand is commonly unreasonable. As a result there is an unfortunate disregard and disrespect for each other. Nothing can be accomplished when this is so, yet it is so. In a business organization the production department is helpless without a good selling department. The reverse is equally true. There must be mutual respect and co-operation between these if the business is to succeed.

We will now consider the more technical aspect of our problem, namely, how research can help in the practice of forest management. It is commonly claimed that about one-third of the volume of the living tree is used and that the other two-thirds are wasted. If research can give this wasted two-thirds a value, twice as great as the used one-third, then nothing would be wasted, and it would in many cases pay to grow trees and to manage forests.

I wish I knew how to do this. Frankly, I do not. I am not big enough, but this fact is not keeping me from trying and I know that it is not keeping many of you from trying. Maybe if we can keep at it long enough and there are enough of us, we can accomplish something. Then, again, maybe we cannot. At any rate, I have made this my life's job, and I hope I am making some progress.

Out West there is a tree, little respected by lumbermen. They do not like it. It makes too much poor lumber and there are too many of these trees growing among the "good" trees. For the past three years I have been devoting most of my time to studying this tree. I have spent several thousands of dollars and many sleepless hours on it. I expect to spend many more of both. The lumber from this tree (and this is now the only salable product gotten from it), does not bring a gross return of over \$50 per thousand, even in these days of high prices. As a result of three years of study, on the part of my associates and myself, I have developed through research eleven com-

mercial products, which I believe can be made from this tree at a profit. If I am right in this, instead of bringing \$50 per thousand gross returns this tree will bring \$240 per thousand, and all of the tree, with the exception of the stump and small limbs, will be used, even the bark. Of course, I may be entirely wrong in this belief. I hope not, because the money spent has been advanced by certain broad-guage lumbermen, and I am anxious to have it return to them, with good interest added. Assuming I am right—I always like to assume that—is it not reasonable to believe that such utilization would entirely alter the present methods of cutting up this tree? Personally, I believe this new plan of utilization will even go so far as to make it pay to grow this tree. In other words, to practice real forestry on it.

Here in Wisconsin there is a fine research problem being sadly neglected. I refer to the utilization of hemlock bark. Thousands of cords of this bark have been and are being wasted, although at the present high prices for bark, this loss is fortunately reduced. Why is this so? Because lumbermen are still practicing the same antiquated methods of peeling this bark which were practiced years ago. If a practical method of removing the bark from the logs in a machine were developed so that these dinosaurian methods of peeling now practiced were abandoned, it would undoubtedly result in all of the bark being used. Who is to do this? The problem is not a difficult one mechanically, yet where is the man who is willing to risk some of his money in the development of such a machine? Those who would be most directly benefited, unfortunately, are the most backward. The Forest Products Laboratory has proved conclusively that bark peeled mechanically and dried artificially gives excellent results in comparison with so-called "leaf bark." And furthermore, after the tannin has been extracted from the bark it is possible to use the extracted residue for manufacturing into roofing felts and similar materials. Dr. Kress has shown this. Yet who is using his research? To my mind it furnishes a good example for a commendable piece of research lying dormant, the reasons for which would make an interesting paper for this Society.

In the use of hardwood limbs, tops, and defective material, there is another excellent research problem in Wisconsin. This industry—the destructive distillation industry—flourished during the war, but it would be practically dead now if it were not for the unusual price of wood alcohol. I believe that properly directed research could be made to develop for this industry, a strong and steady demand for its

products which would release it from the violent price fluctuations that now burden it. This, in turn, would enable a very close utilization of hardwoods which would add to the wealth of the forest and aid in the practice of forest management,

In the Appalachian Mountains research work has developed an interesting situation. It has shown that the chestnut tree can be completely utilized for the manufacture of a grade of tannin which produces an excellent quality of leather. As a result of this it is possible to use the entire tree with the exception of the very small limbs. Not only has research developed this use, but it has gone further and worked out a method of producing pulp from the chips left after the tannin has been extracted. This development work has added to the value of the chestnut, and chestnut forests in the Appalachians are now being given a reasonably careful system of forest management.

In the manufacture of paper and articles made of wood fiber, there is a most excellent opportunity to work out valuable developments because in fiber making practically the whole tree down to three inches in diameter can be used. I think we have not begun to appreciate in this country the value of the various products which can be made from fiber. But even taking the products which have thus far been developed through research, it now pays to grow certain trees for the manufacture of paper and there are a number of private companies which are scientifically managing their pulpwood forests.

An interesting example of what research has done in the way of obtaining a greater financial return from the forest is found in Pennsylvania. I made a survey of what a lumber company was doing in this State about six years ago. This company was cutting approximately 18,000 feet of hemlock logs per acre, valued at \$16 per thousand for the logs. The return from hemlock logs, therefore, was \$288 per acre. In addition to this, the company was gathering all its hemlock bark. It secured about four and a half cords per acre, valued at \$10 per cord. It gathered the hemlock tops and culls for pulp and secured about five cords per acre for which it received \$4 per cord. It sold its mill waste for both kindling and pulp and secured a return of about \$25 per acre from this source. The hardwoods were utilized for the manufacture of staves, about 13,000 per acre being obtained, valued at \$6 per thousand. The small and defective hardwood waste was cut into "chemical" wood, an acre producing twelve cords and the company secured \$4 per cord. In other words, by practicing these close methods of utilization for which research work laid the founda-

tion, this company was receiving a gross return of approximately \$500 per acre, whereas had it cut the timber only for lumber it would have received less than \$300 per acre.

To me, research in forest products has always been the most interesting phase of forestry. What is the use of growing trees if they have no use? I believe that forest products research will encourage silvicultural methods and methods of forest management. Having

Rate of growth of certain trees.

Species	Age (years)			
	30		50	
	Diameter, inches	Height, feet	Diameter, inches	Height, feet
Catalpa	9.0	45	....	...
Chestnut	9.3	57	13.4	77
Cottonwood	21.7	126	30.4	143
Black gum.....	28.0	140	....	...
Blue gum.....	11.2	87	16.8	106
Black locust.....	9.0	55	....	...
Loblolly pine.....	10.0	59	15.9	86
Redwood	10.7	71	14.5	95
White oak.....	7.8	67	12.1	90
Douglas fir.....	7.4	48	13.7	80
Black oak.....	6.9	53	11.3	75
Red oak.....	7.6	56	12.4	76
Jack pine.....	6.2	40	8.5	50
Norway pine.....	5.8	45	10.3	75
Scrub pine.....	6.5	46	8.9	63
Western yellow pine.....	7.1	35	12.2	61
Black walnut.....	8.0	40	12.0	60
Arborvitæ	2.2	15	3.8	28
Red gum.....	1.3	9	2.9	20
Chestnut oak.....	2.3	20	5.6	35
Longleaf pine.....	3.0	29	6.7	52
Tamarack	2.9	32	5.0	50

once established the use for trees, silviculture can then aid by showing what are the best ways to grow the trees for which the uses have been established. For example, the uses for chestnut already pointed out will probably show to the forester that this can be best propagated on a coppice system under which it will produce the greatest volume of wood in the shortest time. Research in wood preservation will justify the growing of such rapidly decaying trees as loblolly pine for ties. Research in paper making has justified the growing of certain

trees for pulp. There is an excellent opportunity for real co-operation between research workers in forest products and research workers in silviculture.

I have listed (p. 595) three groups of trees, all of which grow in the United States. The first two groups are trees which grow rapidly, the third group contains trees which grow very slowly.

It would appear that research work aimed at developing uses for the rapid growing trees listed in groups one and two, would stand a much better chance of aiding forest management than research work directed at discovering products to be made of trees listed in the slow growing group.

Several years ago Kellogg and Ziegler prepared an interesting paper on the cost of growing timber. Of course their data is now out of date, but I nevertheless give it as illustrating a point which I wish to establish, namely, that forest products research on rapid growing species will prove more profitable than on slow growing species. Kellogg and Ziegler assumed that the land was cut over and was to be restocked, taxes would be 10 cents per acre per year up to twenty-five years, thereafter taxes would be 1 per cent of actual value, this to be reassessed every five years. They assumed that forest protection would cost 2 cents per acre annually, that the land was worth \$3 per acre and the cost of stocking it \$7. Interest was compounded at 4 per cent. On this basis, they arrived at the following conclusions: In thirty years loblolly pine would produce 15,000 feet per acre at a cost of \$2.47 per thousand. Longleaf pine in seventy years would produce 17,000 feet per acre at a cost of \$11.56 per thousand, and in one hundred and twenty years 38,000 feet per acre at a cost of \$39.12 per thousand. Douglas fir in forty years would produce 24,000 feet per acre at a cost of \$2.31 per thousand, and in fifty years 35,000 feet per acre at a cost of \$2.48 per thousand.

Assuming that these figures are essentially correct, it is interesting to note that the longleaf pine would have to be over three times as valuable as loblolly pine and over five times as valuable as Douglas fir in order to make its propagation as attractive financially. In other words, research work in forest products aimed at investigating the properties and products of such trees as longleaf pine, is going to have a much more difficult problem to solve to get forestry on a permanent basis, that is, practice forest management, than if it tackled such trees as loblolly pine and Douglas fir. Has anyone ever seriously studied

the ailanthus from this point of view? I think this tree would indicate some very interesting possibilities.

My remarks have been general. They have necessarily been so because I fully appreciate my lack of real knowledge on this rather intangible subject. But I hope that you will agree with me in that research has a direct bearing on forest management and a very important one, that the problem is of immense magnitude, that it is extremely complex, and that research work, however brilliant, will fall far short of its goal unless it is properly proportioned and realizes at the outset that it can play only one part, small but important, in the laudible attempt to manage, and thus perpetuate, our great forest resources through wise use. If this paper has contributed anything of value toward the accomplishment of this subject, it will have served its purpose.

NATIONAL FOREST POLICIES: A CRITICAL REVIEW OF THE SEVERAL PLANS

BY FREDERICK E. OLMSTED

Soon after the war came to an end the need for a national forest policy became self-evident. The difficulty of obtaining ample supplies of wood materials during the war and the shortage and high cost of wood and other forest products immediately afterwards, were factors which brought to view most strikingly the importance of keeping the timberlands of the Nation well stocked. It was generally admitted that our wood supplies were approaching a low ebb and that we were not taking suitable measures to remedy the situation. Early in 1919 both the Society of American Foresters and the United States Forest Service began to agitate the subject and now, in spite of many other distracting problems, the public is beginning to realize that something must be done to stop forest devastation wherever privately owned timberlands are lumbered, and to perpetuate forest growth wherever lands are best suited to that purpose.

In the days following the armistice there was hope that the Nation would be led to undertake a systematic and comprehensive program of reconstruction. This hope proved futile. The political, economic and social affairs of the country were allowed to drift, except for such unpublic guidance as the great nation-wide private interests afforded. If the country had set about systematically to put its house in order, in harmony with the changed conditions and on the broad basis of public welfare, the solution of the forest problem would now be much easier, for it would have profited from the impetus given by a concerted national movement in the direction of progress. As it is, foresters find themselves fighting not only against the particular private forest interests concerned, but also against a general wave of reaction and indifference such as this country has seldom witnessed. That the public, in spite of its lethargy toward economic problems, is awake to the necessity for national action to perpetuate its forest resources, serves only to emphasize the present critical situation.

Several national forest programs have been put forward for consideration and action. The most prominent are those of the United States

Forest Service, the American Paper and Pulp Association, the National Lumber Manufacturers' Association, and the Society of American Foresters (Committee for the Application of Forestry). For the sake of comparison and criticism they are summarized briefly below.

UNITED STATES FOREST SERVICE

The plan advanced by the Forest Service is perhaps most clearly laid down in the so-called Capper Report (Report on Senate Resolution 311, Government Printing Office, June 1, 1920). Its essential provisions are as follows:

Federal Legislation

An annual appropriation of not less than \$1,000,000 for co-operation with the States in fire protection, cutting methods, reforestation, and land classification. The States to contribute an amount equal to that allotted by the Federal Government. The Secretary of Agriculture to be authorized to require certain standards for the disposal of slash, fire protection and cutting regulations. Co-operation to be withheld from those States not complying with such standards.

An annual appropriation of at least \$2,000,000 for the purchase of lands under the Weeks Law, its provisions to be extended to all parts of the country.

An annual appropriation of \$500,000, to be increased to \$1,000,000, for the reforestation of denuded lands in National Forests, the work to be completed within twenty years.

An appropriation of \$3,000,000, available for from two to four years, for a survey of the forest resources of the United States.

A moderate appropriation for the study of forest taxation and forest insurance.

The exchange of National Forest land, timber or transferrable timber certificates for private timberland or cut-over land within or adjacent to existing National Forests.

Withholding from alienation, except under the mineral laws, all government lands chiefly valuable for the production of timber or the protection of watersheds and which are not now in National Forests or National Parks.

State Legislation

Organized fire protection for cut-over as well as timbered lands. Every forest owner, large or small, to bear his share of the cost, private owners to contribute about one-half the expense.

Regulations for the disposal of slashings, and for cutting timber or extracting forest products (such as naval stores or pulpwod).

The administrative agency to be a non-partisan commission with wide latitude to determine regulations. Commission to be backed by laws providing suitable penalties for non-compliance. It should be authorized to grow forest stock and distribute it at cost, and to advise and assist private forest owners in the practice of forestry. It should be charged with the acquisition and administration of State Forests.

Measures for increasing State and Municipal Forests.

Studies of forest taxation.

AMERICAN PAPER AND PULP ASSOCIATION

The plan suggested by this organization is embodied in the report of its Committee on Forest Conservation, published April 15, 1920.

The program is practically the same as that advanced by the Forest Service. The various measures are so similar that a detailed statement would be merely a repetition of most of the clauses given above. It will suffice, therefore, merely to note the differences and additions in the Association plan.

Federal Legislation

Under appropriations for co-operative work with the States an annual sum of \$1,000,000 is suggested at the start, with "automatic increases up to a maximum of \$5,000,000 as the States qualify under the provisions for co-operation." The distribution of forest planting material is included in this clause.

For the purchase of lands under the Weeks Law an annual appropriation of \$3,000,000 is recommended.

The appropriation for forest planting in National Forests is placed at \$1,000,000 from the start.

The appropriation for forest surveys is put at \$500,000 a year, to continue as long as necessary.

A permanent annual appropriation of \$500,000 is recommended for forest research and investigation, for the most part in the field of wood utilization.

State Legislation

Authorizing the States, on request, to take charge of the reforestation of private timberlands, the cost to be a lien on the crop when harvested.

Authorizing the States to take over private forest lands at a fair valuation in case the owners fail to avail themselves of the opportunities and assistance provided by the public to encourage forestry upon private lands.

COMMENT

These two plans possess many excellent features, such as measures for the regulation of timber cutting, the disposal of slashings, increased appropriations for protection against fire, and the acquisition of forest lands by the Federal Government, the States and Municipalities. There can be no argument as to the desirability of such measures.

The advisability of making large Federal appropriations for forest surveys might well be questioned. Is the game worth the candle? The estimates of forest resources we already have appear to be ample for our purposes and in most regions further surveys would be merely a duplication of work already fairly well done. There is no disagreement as to the main facts of the present forest situation, and nothing would be gained if, after four or five years, we should estimate that we had somewhat less or somewhat more standing timber than our present figures indicate. A measure of this sort, moreover, would undoubtedly be used as a plea for delay in the application of a forest program. In the light of present information such an expenditure is not justified.

Similarly, an appropriation of \$1,000,000 a year for planting on the National Forests is open to argument. That is a large sum to use on work which, taken as a whole, has been of questionable success in the past. Artificial reproduction is costly when compared to natural regeneration, and the results uncertain. Is the expense warranted?

The fatal weakness in both these plans, however, is in the administrative method through which results are expected. They assume that the various forested States can be subsidized to pass intelligent and efficient laws, laws with teeth (no other kind of laws are worth anything); that, if passed, such laws will be wisely but rigidly enforced; and that the treeless Middle West and the deforested East will contentedly sit by and leave the task of perpetuating the Nation's remaining forest resources to the legislatures of the still timbered States where the lumber interests are strongest, appropriating their good money toward this end. All these assumptions are fundamentally in error. Forest perpetuation is a national problem, and for its solution direct national control is obviously essential. State control is neither politic nor expedient, and because of its weak and vacillating character would utterly fail in accomplishment.

Both these plans, moreover, emphasize protection against fire as if it were a sort of mechanical panacea for all our forest ills. We are aiming to keep forest lands producing trees. *Silviculture* does that.

and *silviculture* is the thing we should emphasize above everything else. Protection against fire, important as it is, should be regarded purely as a silvicultural measure, as one of those silvicultural measures essential to the perpetuation of forest growth. The leaving of seed trees, the disposal of slashings, and then the protection of cut-over lands against fire are some of the fundamental silvicultural measures wholly essential, in most regions, to the prevention of forest devastation, devastation directly chargeable to destructive lumbering. When timber is harvested the land must first be left in such shape as to make natural reproduction probable and safe, for otherwise money thereafter spent for protection against fire would be thrown to the winds. Why waste good dollars on the protection of devastated lands? The over-emphasis of the importance of fire protection is an insidious danger, tending to befuddle the real issue.

The provision that the State should take over private forest land in case the owner fails to take the necessary steps for keeping it productive, deserves comment. We must readily agree that large additional areas of forest land should be owned by the Federal and State governments. This is a doubtful way to go at the matter, however. Would it not mean that the owner, if he chose to do so, might proceed to devastate his forest land and then sell it to the State, presumably not without profit to himself? Our object is to keep private forest lands productive, not to offer the private owner facilities for unloading his cut-over lands upon the State after they have been skinned and made waste. The time to perpetuate forests is when the timber is cut, not after the harvest when the lands have been so devastated as to be made productive again only through planting at great cost to the State or Nation.

NATIONAL LUMBER MANUFACTURERS' ASSOCIATION

The plan announced by this association was framed by its Forestry Committee and approved by its Board of Directors, July, 1920.

Federal Legislation

An appropriation of not less than \$1,000,000 annually for co-operation by the Forest Service with States and forest owners willing to bear an equal or greater share in the costs of locally applicable systems for protecting from fire both forests and forest lands which are restocking.

An adequate appropriation for the prompt survey of the Nation's forest resources, in co-operation with forest producing industries, States, and other sources of information.

Adequate provision for research by the Forest Service, to determine methods of wood utilization, wood preservation, forest reproduction, and the control of insects, disease and other forest enemies.

Liberal provision for the selection and acquisition, by purchase and exchange, of such lands as should be added to the National Forest system to secure their best protection and management in the public interest.

Provision for replanting such denuded areas in the National Forests as are evidently not to be restocked by natural processes.

In addition to the above specific recommendations for Federal legislation, certain general principles are approved. The need is recognized for the development of an intelligent, practical, equitable and concerted program for the perpetuation of forest supplies. The Government should lend encouragement and assistance to the States in forest improvement, protection and tax reform, making provision to reimburse local taxing units for loss of taxation due to the acquisition of lands by the Government. The Army should be utilized in emergencies for fire fighting and for aviation patrol. There should be a wise, consistent policy for the marketing of publicly owned timber. The Forest Service should lead in forestry thought, but should have no regulatory control over private forest lands unless the owners agree to it.

The statement is made that State legislation is properly for local self-determination, and no suggestions for State legislation are offered beyond certain general principles, as follows:

Suggested Principles for State Legislation

Fire prevention, in co-operation with the Federal Government.

Acquirement by the States, by purchase and by the exchange of stumpage for land, of much larger areas of permanent forest land than they now possess, such acquirement to be largely of cut-over land. The States and the Federal Government to be empowered to condemn and pay for deforested land in case the private owners refuse to sell it or to take reasonable steps to keep it in timber crops, prices to be comparable to those paid in voluntary transactions.

Co-operation by the States in the classification of forest land.

Questions of private and public responsibility or of police power should be decided locally in every instance and be the subject of State legislation, if of any. The lumber industry should be duly represented on committees, boards or commissions dealing with the adoption of

enforcement of State forest policy or legislation, such, for example, as questions relating to methods of forest protection and perpetuation.

COMMENT

This program may be taken, no doubt, as the lumbermen's plan for perpetuating the forest resources of the Nation, resources which are largely owned by the lumbermen themselves. The most important part of this plan is the following paragraph:

"It is recognized that both national and industrial welfare demand early development of an American forest policy which shall substitute for indifference or accident an intelligent, practical, equitable and concerted program for the perpetuation of forest supplies."

When we compare this statement with the absolute indifference to and frequent hostility toward the perpetuation of forest resources heretofore shown by the lumber industry, it means a revolutionary change of attitude on the subject. Hardly more than a year ago lumbermen as a class were ridiculing or belittling the attempts of foresters to impress upon the public the seriousness of the forest situation. They both denied the emergency and disclaimed all responsibility. They have now completely reversed their stand, openly recognizing the need for a national forest policy and admitting that the lumber industry itself is directly concerned in the application of better forest management. This is progress, indeed.

It is perfectly natural that lumbermen, at least for the present, should hesitate to approve any program aimed at real accomplishment. We must not overlook the all important fact that the public, not the lumbermen, will decide what to do, and do it. Bearing this in mind, it is but natural that the lumbermen's program should lack those points quite essential to real accomplishment. Why should the lumber or any other industry suggest or accept regulation until public pressure makes it unavoidable? Here is an industry which, seeing that it is bound to be put under control, is beginning to fight for just as little control as possible, and the Association's program should be interpreted with that fact in view.

A casual reading of this plan gives one the impression that it agrees with the plan of the Forest Service. When more carefully considered, however, it is clear that it does nothing of the sort. It makes a promising gesture, and then sinks into the realm of harmless generalities.

Under Federal legislation it follows the Forest Service and the American Paper and Pulp Association in recommending an annual

appropriation of \$1,000,000 for protection against fire in co-operation with the States; *but*, it omits the provision included by both those organizations which requires that before allotments are made to the States the States themselves must meet certain standards for forest perpetuation and protection, such standards to be fixed by the Federal Government. In other words, the lumbermen are in favor of Federal subsidies to the States without any strings attached (except that the States must contribute equal amounts). Such a plan is intrinsically evil.

Later on, to be sure, the program contains the following statement:

"Uncovered by the foregoing twelve principles of national bearing are those questions of private and public responsibility or of police power which because of varying conditions and the rights of States should be decided locally in every instance, and be the subject of State legislation, *if of any*."

Which means that the lumbermen, quite naturally, would prefer to get along without any controlling legislation at all, if that were possible. In case legislation is necessary, they want it to be local only. This means, simply, that even if the States should legislate, the Nation would have nothing whatever to say about the methods of expending national funds donated for the national welfare. A nation-wide problem would be referred to and decided by local authorities, *if any*. Under whose guidance, in most cases, would these local authorities act? The idea is admirable—from the lumbermen's standpoint.

Other suggested measures relate to forest surveys, forest research, the acquisition of forest lands, and replanting, all of which have been discussed previously and none of which are vital to the problem of immediate importance. Incidentally, all of these measures are of profit to the lumber industry. It is worth noting, perhaps, that in suggesting the acquisition of lands it is recommended that the Federal Government should purchase only such lands as should be added to the National Forests "to assure their best protection and management in the public interest." Evidently no extensive acquisition by the Nation is advised. In the case of both the Federal Government and the States, the advisability of acquiring largely cut-over lands is emphasized.

Apparently when lands are to be acquired through condemnation, only deforested lands are considered. This method of acquirement has already been discussed. It locks the stable door after the horse has slipped away, and is dangerous in the extreme unless accompanied by such regulation as will prevent forest devastation when the timber is cut. If so accompanied the measure is a proper one.

The remark is made that "the Forest Service should be the recognized leader of public forestry thought and effort along general lines, because of its impartial position and broad educational facilities, but vested with no regulatory control over State or private lands not mutually agreed to by the owners thereof for specific purposes in connection with the general policy herein suggested." The Forest Service is not in an impartial position. It is the servant of the public, and is in duty bound to safeguard and work for the public interest against any and all interests at variance with the national welfare. That the Forest Service should lead public thought on forest affairs goes without saying; but that it should stop at that is to make the public's chief forest agent impotent to advance the public's own interest. The Forest Service should be an active agent both in securing and executing such national laws as are essential to the solution of the national forest problem.

SOCIETY OF AMERICAN FORESTERS, COMMITTEE FOR THE APPLICATION
OF FORESTRY

The report of this committee was published December 29, 1919, and at the annual meeting of the society held in New York, January 14, 1920, it was voted to place the report before the society as a whole for a referendum ballot, the vote to be taken clause by clause. The result of this ballot is published in another article of this issue of the JOURNAL, and shows that with one exception (the measure relating to business reports from lumber industries) every clause both of the plan and of the suggested legislative program was voted upon favorably, the principle of national control winning by a vote of more than three to two. Two out of the four suggested enforcing clauses were voted upon unfavorably.

The essential provisions of the Committee's plan are as follows:

Federal Legislation

The creation of a Federal Commission, with direct administrative control over forest devastation on privately owned forest lands.

The execution of the law to rest with the United States Forest Service.

The localization of such Federal control by the formation of administrative districts, apportioned with due regard to natural forest conditions and the economic needs of the country.

The requirement of reports from forest industries on certain business matters.

The withdrawal of Federal control whenever the owners or operators in a forest unit or units are preventing or will continue to prevent forest devastation.

The sanction of co-operative combination of lumber manufacturers for purposes resulting in economies of production and marketing, whenever that will promote the public interest.

Largely increased financial assistance from the Federal Government to the States for protection against fire, provided that the plans and measures adopted by the States are of such excellence as to justify such financial assistance.

Acquirement by the Federal Government of timbered and cut-over lands, by certain suggested methods.

Authorizing the Forest Service to carry on such operations on the National Forests as may be necessary to harvest and market forest products.

Authorizing the creation of a national forest loan board, and forest insurance agencies.

Granting recognition to regional and national boards of lumber employers and employees.

Enforcing clauses, with penalties for non-compliance.

State Legislation

Suitable measures for the protection of forest lands against fire, such measures to meet the requirements of the Federal Government before financial co-operation is granted.

Acquirement of forest lands by States and Municipalities.

A study of forest taxation, in co-operation with the Federal Government and other agencies.

DISCUSSION

The Committee's plan, also, has many features in common with that of the Forest Service, such, for example, as financial assistance from the Federal Government to the States for protection against fire, provided the States meet certain requirements; the acquisition of forest lands by the public; and studies of forest taxation.

Provisions not included in other programs relate to direct Federal control, business reports from lumber industries, the withdrawal of governmental supervision whenever circumstances warrant, the combination of lumber manufacturers, operations by the Forest Service on National Forests, the recognition of boards of lumber employers and employees, and the establishment of forest insurance agencies.

If we except the provision for direct national control, those measures peculiar to the Committee's plan are, perhaps, of minor importance to the main problem. They may be considered merely as possible aids

to the solution of the question as a whole and, for the moment, may be put aside as being of secondary concern.

The provision for direct national control, however, can not be put aside. It is the outstanding feature of the whole plan, and this proposal constitutes a difference of fundamental importance between the Committee's program and all others. In the plans of the Forest Service and the American Paper and Pulp Association the power and authority to stop forest devastation is vested in the separate States; in the Committee's plan this power and authority rests with the Federal Government. Although the thing to be attained is precisely the same in all three plans—namely, compulsory governmental control over private forest lands—the machinery through which control is to be applied differs radically.

Opponents of the Committee's program have argued that its constitutionality is in doubt, to which the Committee has replied that the best of legal advice points to its constitutionality upon several grounds and that, at any rate, it is futile to argue the matter unless and until it comes before the Supreme Court, the only body capable of rendering a final decision. The plan has been called un-American and undemocratic, which has been met by the statement that the Nation has already solved many similar big problems in a similar way without having lost any appreciable amount of Americanism, and that national control is more democratic than any other provided, always, that the administration of that control is made intensely local, as it should and could be made. It has been objected that friction would arise in case protection against fire were left largely to the States, and the prevention of destructive lumbering to the Federal Government. To this the Committee has answered that no plan can be devised which would eliminate altogether the possibility of friction; and it has drawn attention to the fact that the plan of the Forest Service involving, first, subsidized dictation to the States as to how they shall legislate and administer their laws to prevent forest devastation, and, second, constant Federal inspection to see that necessary standards of efficiency are lived up to, would surely give rise to very grave friction indeed. It has been suggested that under national control a set of iron-clad regulations might be applied to the country as a whole, regulations unsuited to the numerous peculiarities of local forest conditions. The Committee has replied that such, indeed, might be the case; but that there is still enough horse sense left in the country to insure decentral-

ization, thorough-going local administration, and local regulations for local forest conditions. The Forest Service, under national laws and national control, has for many years made timber sales in many different parts of the United States and under many different forest conditions, necessitating as many different silvicultural methods in the cutting of timber. There is no evidence to show that the Forest Service has been attacked on the score of applying iron-clad, nationwide rules and regulations. Under localized administration it has solved local problems on the basis of local conditions, both in the forest and on the range.

The advantages of national control which, apparently, have not been seriously disputed, are that in comparison to State control it is distinctly more intelligent, more stable, much freer from politics, practically closed to influence from private interests, and in general immensely more efficient. The Committee has pointed out the unintelligent, weak, transitory, and politically involved State forest administrations, examples of which abound; and it has asked how, under such conditions, real accomplishment can be expected.

It may be added that a Committee on Forests has recently been organized by the National Conservation Association, and that this Committee has already met and discussed plans for the perpetuation of the forest crops of the Nation. The program to be urged by this Association will doubtless be published in the near future and will be reviewed in the JOURNAL OF FORESTRY later on.

TOLERANCE OF FOREST TREES AND ITS RELATION TO FOREST SUCCESSION¹

BY GEORGE P. BURNS

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It is with considerable reluctance that I appear before this body of practical and experimental foresters to discuss briefly the problem of tolerance of forest trees and its relation to forest succession. This is especially true because the results of my own ecological work, both that of observation in the forests and of experiments in nursery and greenhouse, do not apparently assign to light the all-commanding position with which it seems to be associated in the minds of many persons engaged in the work of silviculture. The literature of this subject is closely interwoven with the words "tolerance" and "intolerance" and an agreement as to the exact meaning of these words on the part of all workers in this field is essential as a starting point for a clear understanding of the problems in hand.

Dr. Fernow says that the present theory of tolerance was first systematically developed by Heyer and published in 1852, and on this work is built the whole philosophy of silvicultural methods. At the time of its origin then it was based wholly on observation. It was published 10 years before Roscoe-Bunsen published their important work on *Meteorologische Lichtmessungen*, 20 years before the important work of Wiesner began to appear, 51 years before the appearance of Schimper's plant geography, and many years before forestry literature began to be illuminated by the writings of Zon, Clements, Bates, Hoffman, etc. In fact all of the ecological work which is based on exact research has appeared since that date.

Dr. Fernow says that "Tolerance means to the professional foresters only a light relationship and nothing more." It is the intention of the writer to attempt to analyze some of the literature to see whether or not this idea is shared by all foresters.

In accordance with the present theory trees are arranged according to their so-called light requirement into a series beginning with the

¹ Delivered before the Society of American Foresters at its annual meeting in New York, N. Y., January 14, 1920.

most intolerant then gradually passing to the most tolerant or shade-enduring species. In the matter of succession some ecologists at least see in this series a true genetic relationship and on this so-called light requirement alone ignoring entirely the soil factors, they tell us that forest succeeds forest until we reach a "climax forest." On the other hand, there is a marked tendency toward the position of the late C. A. Davis who, working in northern Michigan, insisted that there were at least five climax forests, the determining factor being the soil conditions as opposed to the opinion just given that there was only one climax—a maple-beech-hemlock climax forest—a climax because its components were tolerant of shade.

What are the standards of judgment used in determining the tolerance or intolerance of trees? A study of the literature indicates that they are (1) color and structure of the foliage, (2) the inability of the foliage to survive in the interior of the crown, (3) the ready loss of lower branches, (4) the length of needles in the conifers, (5) rapidity of height growth, etc.

Such is the theory, but let us examine a little closer into the literature. It at once becomes evident that tolerance does not mean the same thing to all foresters. The so-called light relationship is a complex affair and requires the most careful analysis. Physiologists have shown that only 1 per cent to 2 per cent of the light is used in photosynthesis. Foresters do not agree about this 2 per cent, but quickly divide into two groups, the one claiming that it is the quality of the light which determines tolerance. Zederbauer has claimed that trees are attuned to different qualities of light, and a study of tolerance then would consist in determining what rays of the spectrum are best suited to the different species. Intolerant trees would require white light, tolerant trees would grow well on filtered light. It is not necessary to enter into a discussion of this idea of tolerance. Suffice it is to say that I believe that his methods were wholly untrustworthy. When one considers the work of Linsbauer and Griffon on the action of light which has been filtered through green leaves and the later work of Knuckel with the spectroscope, it hardly seems that this view of tolerance is at present very well established.

To Wiesner, and perhaps the great majority of plant ecologists, the light in the forest is a weakened white light. The difference is one of quantity rather than one of quality. The light varies from the direct sunlight to the very weak intensities found under vegetation.

Physiologists agree that the specific assimilatory energy varies with different chloroplasts. Zon transfers this thought to forestry when he says that "each species requires a certain amount of light which cannot be changed by environment." Lubimenko attempted to show that this variation on the part of the chloroplasts was sufficient to account for the succession of trees. He found that the initial light intensity at which photosynthesis begins in the case of two tolerant trees—fir and basswood—was only one-fifth the intensity required by intolerant trees—birch and pine. To him tolerance means a definite thing, namely, the difference in sensitivity of the chlorophyll bodies to white light. It was a splendid piece of work attempting to give his theory of tolerance a scientific basis. However, his source of light was a gas flame, and too great weight cannot be placed on his results.

I know of no work of this kind dealing with the maximum light which trees can endure, but the literature of plant physiologists and foresters states that the diffuse and not the direct light is the most important for photosynthesis. Ewart has shown that too strong a light may be an inhibiting factor in food manufacture.

One of the standards used in judging trees as to tolerance was stated as the structure of the leaf—its position, size, and compactness. The work of Stahl has shown that these leaf structures may be influenced by light, and he speaks of sun and shade leaves. These terms are familiar to us all. However, Transeau, working with some shrubby and herbaceous forms, was able to develop shade leaves and sun leaves by controlling the temperature of the soil by means of coils of glass tubing through which ran iced water. He says, "All of these xephilous characters may be produced by growing the plant in an undrained wet sphagnum substratum whose temperature is maintained a few degrees below that of the air. This effect is obtained even in subdued light." In this work palisade is to be associated with drought rather than light. If this work had been done first we might have been speaking of warm soil leaves and cold soil leaves instead of sun and shade leaves. In fact we find in the literature the suggestion that our tolerant trees are hydrophytic and our intolerant trees are xerophytic, and it has been suggested that these two words supplant tolerant and intolerant.

This would make light, if we accept Stahl's work, only an indirect cause of tolerance. However, this work of Transeau's cannot be ignored, and it suggests a field which foresters must work out in refer-

ence to tree growth. Whatever the casual factor for the variation in leaf structure, whether it be light or soil temperature, the plant is adjusting itself to its water supply, and the structure of the leaf cannot be used as a standard of judgment for tolerance if tolerance is a "light relationship and nothing more."

Still another view of tolerance is expressed by Bates. He emphasises the importance of the large amount of light which strikes the leaf and is used by the plant as heat. That heat is one of the most important limiting factors in photosynthesis is well known. The argument runs something as follows: Intolerant trees receive a large amount of light, but owing to intense transpiration, due to the wind, the temperature is lowered and photosynthesis proceeds slowly; tolerant trees receive less light, but in their sheltered position they transpire less, hence their temperature is lowered less. Accordingly the weakened light, plus the higher temperature, is about as effective as the stronger light and the lower temperature. We might add to this that plants in the shade have a decreased respiration, and hence need less food to maintain themselves. Apparently to Bates, tolerance is not a light relationship but a heat relationship. This phase of tolerance should not be overlooked, and Bates deserves great credit for his suggestion.

If tolerance is a matter of the sensitivity of the chloroplast to light or to heat, how can these be modified by other factors of the site or habitat? I believe that the great amount of confusion in the field is due to lack of sharp definitions. No one doubts the fact that a chloroplast has its maximum-optimum-minimum intensities but it is a serious question how often the light in the forest gets below the minimum at least to such an extent that it is the limiting factor in forest succession. This last can only be determined by experimental work done under control conditions. What are the factors in the field which influence tolerance or the light relationship of trees? We find in the literature the statement that, due to weaker light, the elm and ash are intolerant in north Germany but tolerant in south Germany. Again trees are intolerant at high altitudes where the light except for clouds is strong, on north slopes, and in raw climates. It would seem that temperature might be the controlling factor in these cases. That is, the tree in north Germany, on the mountain top, on the north slope, and in the raw climate would all be subjected to low air temperatures and the length of the growing season would be the all-important factor.

Again we find the statement that "good soil," meaning, no doubt, in most cases a constantly wet soil, decreases the light requirement. Gayer tells us that birch on good soil produces a dense crown and that spruce on a poor soil is intolerant; that the tolerance of the spruce increases with humidity of the air and on a good soil. Heyer says that the elm is cultivated as "unterholtz" on a fresh soil which is deep and fine, allowing a good root development, a thing that would be impossible on sand. In the very wet years of 1886, 1888, and 1896 some of the intolerant trees in Germany were heavily leaved like the tolerant or shade-loving species.

Mayr explains the increased tolerance of old trees by the fact that they have a larger reservoir of stored water which enables them to be independent of slight fluctuations in water supply and temperature.

Hartig analyzed the so-called light increment which we get after thinning. His researches show that the limiting factor in the trees with which he worked was not light. That the chloroplasts were not working to their full capacity with the light present, but that he could reduce the leaf surface by 40 per cent without decreasing the rate of growth. He found that after a thinning trees which were not exposed to more light thereby, produced much greater amount of wood and this can only be explained by the decrease in root competition for water and mineral foods. The classic experiment of Fricke is known to all and tends to the same conclusion, but his work has never received the recognition it deserves.

Heyer, the author of our tolerance theory, says that all trees are tolerant in a garden soil. I hardly believe he would recognize his theory as it is at present stated in its extreme form.

We have already spoken of the standards by which foresters judge tolerance and intolerance of trees. We have pointed out that leaf structure is not a safe standard, since it may represent a water relationship rather than light relationship. Further, we have seen that the dying of leaves in the center of the crown, even in the birch, is governed by water supply and not by light intensity. I have conducted some experiments with the white pine in which it was evident that the dying of the leaves was not due to light but to water supply. Three miles from the University on a light sandy soil a small grove of white pine was planted 4 by 4 feet. The trees were about 15 feet high and the lower limbs and leaves were dead up to a height of about 8 feet.

Nearby a second grove was found which grew in a wetter soil and the light intensity was only about one-half as strong where the same phenomenon was taking place. We raised a group pine in pots and when they were about 18 inches high transplanted them to the greenhouse, placing them 4 inches apart. As they were pot-grown this damaged the roots systems very little. Arrangements were made to water by pipes on the surface to avoid wetting the leaves. These trees held their leaves and branches at a light intensity many times lower than any that I have ever found in the woods. That is, when abundant water was present the leaves remained and the trees formed very dense crowns. The results of shading white pine with cheese cloth in beds which were abundantly watered, and in beds which received only the rain water which went through the cheese cloth, show conclusively that light is not the chief factor in determining the length of the needles. In the first set there was little difference in the length of the needles grown under one or six layers of cheese cloth. In the second set there was a marked difference, but these plants suffered from lack of water because much of the rainfall was caught by the layers of cheesecloth and evaporated without reaching the soil.

I have not attempted to give an exhaustive review of the literature but simply tried to show that the word tolerance does not mean a light relationship only to all foresters; that it is a confusing term and that its use has made concise thinking impossible. I believe that in the interest of scientific silviculture it should be dropped from the literature. If this is impossible it should be given an exact definition.

The factors which influence tree growth—light, heat, humidity, soil solution, etc.—must all be studied experimentally as they affect forest development, before our silvicultural methods can be put on a scientific rather than a philosophical basis. Until this work has been done, and until we understand the relationship of individual trees and forest types to these factors, we will not be able to understand the natural succession of forests or to form a national policy of silvicultural management. To this end it is highly desirable to establish silvicultural research laboratories in the various forest regions in the country, and the Forest Service should have the hearty support of everybody interested in forestry in its endeavor to advance fundamental research.

A STUDY OF WINDFALL LOSS OF WESTERN YELLOW PINE IN SELECTION CUTTINGS FIFTEEN TO THIRTY YEARS OLD

BY ROBERT H. WEIDMAN

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A few years ago several violent wind storms did a great deal of damage in yellow pine timbersale cuttings on the Whitman and Crater National Forests in Oregon. On one cutting with an area of 1,624 acres, nearly one million board feet of yellow pine was blown down in the storms of May 26, 1913, and September 18, 1914. This blowdown included 17½ per cent of all the reserved trees on the area. So heavy a loss occurring so early in the local timbersale experience (the cutting had been in progress only four years) was a most alarming condition, particularly since the Weather Bureau records showed that regional winds of equal velocity occurred every three or four years. It was feared that a similar heavy windfall loss might occur periodically and that at this rate all the reserved trees would eventually be blown down and the selection method of cutting would become prohibitive in this region.

Since that time a comprehensive increment study of yellow pine on old private cut-over areas has been in progress in Oregon, and has offered an excellent opportunity to examine in detail the history of windfall loss on areas upon which had been practiced, years ago, partial cutting methods resembling the present selection cutting of timbersales. This windfall study aimed to determine the volume of the loss through a long period of years and to ascertain the actual years, with relation to the time of cutting, in which the trees were blown down. With this information at hand it would be possible to say whether all the trees left standing in selection cuttings would eventually be blown down, or whether the greater percentage of them would, in reality, become gradually windfirm and survive the later storms. The ideal conditions for securing the data would have been furnished by areas cut over by a regulated selection method, but forest management is not old enough in this region to furnish such cuttings. Old private cuttings in yellow pine up to thirty years old and more do

exist, however, and for the purposes of this study the stands left after cutting on these areas are not essentially different from those left in Forest Service timbersale cuttings. The old private cuttings contain just as great a proportion of trees left standing as the timber sales, and sometimes a greater; and the trees are nearly as well distributed over the ground. The degree of wind-firmness on the old private cuttings is not appreciably poorer than on those timbersale cuttings which suffered so heavily a few years ago. The reason for this is that the latter contained a greater number of tall and full-crowned trees which, observation has shown, are just as lacking in windfirmness as the trees with defective trunks and basal fire scars found on the private cuttings. Both classes of cuttings contain about the same number of young trees. By old cuttings are meant those cut twenty years and more ago, when logging in eastern Oregon was in its early stages and the logger left a great many trees which he takes to-day with the present closer utilization.

In securing the present windfall data, plots 20 acres or larger were laid out and all the standing and down trees over 12 inches in diameter breast-height were cruised. In addition, the down trees were carefully analyzed as to the year when each tree was thrown, which was readily determined from the number of accelerated annual rings the down tree showed as compared with those of the standing trees. In the few cases in which there was doubt as to whether the down trees had first been killed by fungi or insects and had then been blown down, the trees were not included as windfalls in the compilations of this article.

The plots were located in representative conditions in and near three National Forests in the Blue Mountain region of eastern Oregon. There were three 20-acre plots, one 40-acre plot, and a total of 24 acres of smaller plots, primarily studied for another purpose, but upon which careful notes of windfall occurrence were made. Plots I and II were located in areas of severe wind risk, and Plots III and IV in comparatively sheltered areas. The numerous smaller plots were located in both exposed and sheltered situations and the results given for the aggregate plot are therefore average for a wide range of conditions. The proportion of trees left standing at the time of cutting amounted to the following percentages by volume of the original stand in each case: 12 per cent on Plot I, 8 per cent on Plot II, 40 per cent on Plot III, 8 per cent on Plot IV, and 16 per cent on Plot V.

Table 1 shows for each plot the total number of trees thrown, the volume of these trees, and the percentage of loss. The last is based

upon the ratio of the volume of the thrown trees to that of the total number of trees left standing at the time of cutting.

TABLE 1.—*Total number of trees thrown, volume of the trees, and the percentage of loss for each plot.*

Plot	Area, acres	Windfall loss since cutting			Years since cut- ting	Year when cut
		No. of trees	Volume in bd. ft.	Per cent thrown of volume left stand- ing		
I	20	43	10,745	24 ^a	20	1896
II	40	40	8,995	22	15	1900
III	20	11	11,775	2	27	1889
IV	20	4	1,510	4	18	1897
V	24	34	12,150	14	15	1899

^a Estimated.

The value of this table is that it shows in actual figures the total volume of windfall loss for a long period of years and gives the percentage of the original reserved stand which this figure represents. Plot I shows the heaviest loss in proportion to the stand left at the time of cutting. On this plot nearly 45,000 board feet had been left standing on 20 acres, and the volume thrown in 20 years was 10,745 board feet, or 24 per cent. On Plot II, where the next greatest proportional loss occurred, 41,310 board feet had been left standing on 40 acres and the volume blown down in 15 years amounted to 8,995 board feet, or 22 per cent. The significant thing about these figures is that the loss is not the result of exposure to one or two storms, but of 15 and 20 years of exposure on bad windrisk sites.

An apparent irregularity in Table 1 will be noticed, in that the heavy volume loss on Plot III is represented as an exceedingly small loss in per cent. This is explained by the fact that the plot was located in an unusually heavy body of timber, which ran 30,250 board feet per acre before cutting, and in which the logger cut only very lightly, leaving fully 40 per cent of the original stand. In the case of the other plots the stand before cutting averaged from 13,000 to 25,000 board feet per acre.

Table 2 shows, by half decades, for each plot, the number of trees thrown since cutting. It also shows the percentage of total thrown volume in each five-year period.

TABLE 2.—*Occurrence of windfall by half decades following cutting.*

Half decades after cutting.....	0-5	6-10	11-15	16-20	21-25	26-30
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Plot I—20 acres—20 years since cutting.

Number of trees thrown.....	28	12	2	1
Per cent by volume.....	54	30	5	11

Plot II—40 acres—15 years since cutting.

Number of trees thrown.....	31	6	3	.....	.....	.....
Per cent by volume.....	94	4	2	.....	.....	.....

Plot III—20 acres—27 years since cutting.

Number of trees thrown.....	3	3	2	1	1	1
Per cent by volume.....	33	28	16	1	1	21

Plot IV—20 acres—18 years since cutting.

Number of trees thrown.....	3	1
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Plot V—Aggregate plot of 24 separate acres—15 years since cutting.

Number of trees thrown.....	23	7	4
Per cent by volume.....	67	12	21	.....	.....	.....

The interesting point brought out by Table 2 is that, of all the trees that are windthrown over a long period of years, a strikingly large proportion—often as much as two-thirds or more—is blown down in the first five or six years immediately following cutting. The remainder is thrown in rapidly decreasing proportions year by year until about twenty years after cutting when the loss for a five-year period becomes but 3 or 4 per cent of the total volume thrown. In the actual case of Plot I, 54 per cent of the volume of the entire windfall loss for twenty years occurred in the first half-decade after cutting, and but one tree fell in the fourth half-decade—a 30-inch tree which would not have fallen had the area been under management, because so big a tree would not have been left standing. On Plot II, 94 per cent of the loss for fifteen years occurred in the first five-year period and only 2 per cent in the third five-year period. The same preponderant percentage in the first half-decade holds true for the other plots, except

that it is not so marked in Plot III, where but eleven trees fell in 27 years and most of these were large trees between 24 and 38 inches in diameter.

This concentration of windfalls in the first few years after cutting, with the gradual decrease thereafter, is a striking but not unnatural condition. When the forest in a region of severe winds is opened by heavy selection cutting, it is quite obvious that the weakest of the remaining trees will be blown down by the first strong winds, and that thereafter there will be a natural falling off of the loss as the less weak trees become gradually windfirm.

It will be remarked, however, that the uniform decrease of percentages in Table 2 is disturbed in the later half-decades by unusually high percentages of volume. As can be readily seen from a comparison of the small number of trees thrown with the corresponding high percentages of volume, the trees must have been of unusually large size. This was actually the case, for on Plot I the last tree thrown was 30 inches in diameter, on Plot III the last tree lost was 35 inches, and on Plot V there were two large trees, 26 and 30 inches, included in the last half-decade. Because of their large size and the deep basal fire scars on several of them, these trees were exceedingly bad windrisks, and would not have been left standing under any circumstances by a timbersale marker.

The concentration of windthrow immediately after cutting now suggests the question: Have not the several discouraging windfall losses on timbersale cuttings in the Whitman and Crater National Forests been the result of normally severe storm-winds striking remaining stands when they are most susceptible; that is, in the first few years after cutting, just as in the case of the losses in the old private cuttings described in this article? The specific case of the loss on the Eccles timbersale affords an opportunity for comparison. On this timbersale cutting, which was less than four years old, $17\frac{1}{2}$ per cent by volume of the yellow pine trees in the reserved stand were blown down by the storms of May 26, 1913, and September 18, 1914. This amounted to an average loss of one tree per acre on 1,624 acres. On a permanent 45-acre sample plot, which was established on this timber-sale area in 1914 and has been examined annually, the loss for the remainder of the five-year period following the two severe storms was an average of 0.2 tree per acre. Accordingly the loss on this area was 1.2 tree per acre for the first half decade. On the three plots of this study which suffered the heaviest windthrow, the loss for the first

five-year period was 1.4, 0.95 and 0.17 tree per acre, respectively. Thus, it is seen that the loss on the Eccles timbersale is less as compared with one plot and only slightly more as compared with the others; and the cutting which had a more alarming loss in the first years of its existence still has over 75 per cent of its reserved trees standing after 20 years of exposure.

It is of interest and practical value to express windfall loss in number of trees per acre. In order to have a uniform basis with respect to the time element, the loss for the five plots of this study was computed for the first 15 years following cutting in each case. On Plots I to V this was found to be, respectively: 2.1, 1.0, 0.4, 0.2, and 1.42 trees per acre.

In predicting the future yield of areas under management, it is useful to have these actual figures of windfall loss in order to make allowance therefor. It will immediately be said, however, that such allowance is of little value if loss through other causes than windthrow is not considered also. This point was kept in mind in the present study and total loss was carefully investigated on Plots III and V and on another area. The results of this investigation are quite interesting and will be presented very briefly. The total loss on the 24 acres of Plot V amounted to 46 trees in 15 years, as follows: 34 windfalls, 8 insect-killed and 4 killed by unknown causes. On the 20 acres of Plot III, where the total loss was very light, it amounted in the 27 years since cutting to 29 trees. The causes were recorded as: 11 windfalls, 8 insect-killed, and 10 killed by agencies which could not be definitely determined though believed to be mostly insects. Though fewer trees were windthrown than lost through other causes, the windfall volume loss was 11,775 board feet as compared with 10,245 board feet through other causes. Total loss has also been observed annually on a permanent 45-acre sample plot in a timbersale cutting which is now six years old. On this plot, which suffered in its first year from the severe storm of September 18, 1914, 75 trees have been lost to date: 61 windfalls, 11 insect-killed, 2 fungi-weakened and withthrown, and 1 lightning-killed. It is apparent that windfall makes up the great proportion of total loss, comprising 53 per cent by volume on Plot III and 80 per cent on the other two plots. It should be added that Plot III was located near a large area which suffered a severe epidemic infestation of *Dendroctonus* 10 or 12 years ago.

The value of this study is that it dispels the fear, inspired by the alarming losses experienced on several yellow pine timber sales in

Oregon, that these losses, if continued, would prohibit the selection method of cutting. The results are reassuring on this point, inasmuch as they indicate that, on areas subject to severe winds, a loss as great as 25 per cent may be expected before the reserved stand becomes resistant and that thereafter the big part of the stand will remain permanently on the ground. The results are also important in that they furnish actual figures of windfall loss in number and volume of trees per acre covering a long period of years, which can be used as a basis for the correction of such loss in yield tables—a correction which has heretofore been made upon assumption.

It is unfortunate that it was beyond the possibilities of this study to furnish information by means of which large windrisk areas may be recognized in the virgin forest before cutting is begun. If such information were available, it would be possible, by a modified treatment of the area, to reduce greatly the loss which seems so certain to occur in the first several years after cutting.

The important conclusions of the study may be summarized as follows: Heavy windfall in the first few years following cutting, like that of the timber sale in which $17\frac{1}{2}$ per cent of the stand was blown down, does not presage the total destruction of the reserved stand or even endanger the method of cutting. As high a loss as 25 per cent by volume on bad windrisk areas may be expected in the course of 20 years. Of all the windthrow which occurs over a long period of years, a proportion as great as two-thirds or more usually takes place in the first four or five years immediately after cutting, and the remainder is thrown in rapidly decreasing percentages until about 20 years later when the windfall is so slight as to be negligible. Measured by the heaviest windfall loss encountered, the selection method of cutting is not prohibitive in the yellow pine stands of eastern Oregon.

SUMMER PLANTING OF WHITE PINE ON THE MICHIGAN STATE FORESTS

BY RUSSELL WATSON

In Charge Forest Management, State of Vermont

Summer planting has been so generally accepted as being infeasible on account of high mortality of the seedlings after planting, that the following information, which is based on experiments conducted on the Higgins Lake State Forest, Michigan, and which indicates that summer planting is feasible under some conditions of growth may be interesting to the profession at large.

The experiments were initiated primarily to determine whether spring planting on the State Forests, which usually were stopped the first week in June, could not be prolonged for a week or two; and whether fall planting, which was commenced about the second week in September, could not be started several weeks earlier. To determine this 875 seedlings of white pine (3-0 stock) were planted each week from the first week in June to the first week in September. Planting was done by one of the Forest laborers who worked under no supervision and with explicit instructions to plant the seedlings with only the same care as he had used in the usual spring and fall planting. Trees were underplanted, that is, planted under a moderately heavy stand of maple and oak about fifteen years old. The 875 seedlings were spaced in such a manner as to cover half an acre, that is, five by five feet. The area planted is in no wise particularly different from the many thousands of acres of land that State Forester Schaaf is underplanting to white pine seedlings every year. The seedlings stock which was planted (not at all selected stock) was considered 3-0 stock June 1, but after the season's growth, say on August 1, was considered 4-0 stock. The season was particularly dry; even the hardy shrubs, such as huckleberry and sweet fern, were in many places withered from the drought.

We were confident that, upon examination, we would find a moderately heavy mortality rate, somewhat higher than that of regular spring and fall planting in those weeks immediately following spring planting period and preceding fall planting time, but that the areas

planted in July would show a very heavy mortality rate among the seedlings. We thought it stood to reason that a seedling, dug from a nursery where it had been plentifully watered, at a time when it was growing very rapidly, and supposedly highly susceptible to injury by drought and the shock of transplanting, had little chance for success when carelessly thrust into a slit made by the planting dibble in the dry-as-dust sandy soil of the region.

So we were surprised when, upon examination of the areas in late summer a year later, we found that the trees planted in July and August not only appeared to be more healthy and were larger than those planted in June, but also apparently the percentage of number of survivals to failures was slightly higher. About 80 per cent of the total number of seedlings, planted thus in the summer, survived; this figure is just about the same as that obtained from counts of survivals in the usual spring and fall plantings.

One point which may be of importance as effecting the results of the experiment must be noted, namely, that the seedlings were not more than an hour in transit from the nursery to the field, and that all the 875 seedlings were planted in less than a day. Whether or not a longer period of time, say two or three days in the case of long distance railroad shipments, between time of lifting and time of planting, will increase the death rate of the number of seedlings planted, is a matter of trial.

It is quite certain, however, that on the Higgins Lake Forest at least (where the nursery for the Michigan State Forests is located), fall underplanting can begin early in August with entire confidence of the success of the work.

REVIEWS

The Effect of Forests Upon Streamflow. Untersuchungen über den Einfluss des Waldes auf den Stand der Gewässer, von Dr. Arnold Engler, Mitteilungen der Schweizerischen Zentralanstalt für das forstliche Versuchswesen, Zurich, 1919.

Switzerland is a country of mountains with many villages nestling among them. Close watch must therefore be kept on the mountain torrents which often carry in their wake destruction of life and property. As in our own country, the general experience of the people who lived long in the woods and of foresters who observed the behavior of streams rising in forested and unforested watersheds was that the forest has a beneficial influence upon the flow of water in mountain streams. The need for strict protection of the mountain forests was fully recognized and enacted in national legislation. There were, however, many timber owners who were bent upon clear or careless cuttings of the forests in the mountains because of the immediate higher profits from such handling of their timberlands. There were not a few engineers who sincerely believed that the influence of the forest upon the occurrence of floods and the flow of water in the streams was unduly exaggerated and were chafing under the restrictive forest laws. In order to settle the question of the influence of the forest upon streamflow the Forest Experiment Station at Zurich in 1900 undertook accurate measurements on two small watersheds in the Commune of Sumiswalde, about 15 miles northeast of Berne. In the summer of 1910 a similar project was instituted by the U. S. Forest Service in co-operation with the Weather Bureau in the Central Rocky Mountains at Wagon Wheel Gap, Colorado, the Swiss experiment in its broad outline being used as a model. In equipment and the methods of carrying out the observations and in working up the records, however, as well as in the character of watersheds themselves, there were essential differences. Some of these differences are brought out in the course of this review. The Swiss Experiment Station, after 18 years of continuous observation, has just published its results as worked up to date. It is by far the most conclusive record which forest or engineering literature has so far produced. Its particular value lies in the analysis of the individual factors which affect the regime of

mountain streams and therefore provides a scientific basis for determining for any given condition the effect of forest vegetation or lack of it upon the behavior of the stream.

Of the two Swiss watersheds selected for the experiment, one is known as Sperbelgraben. It comprises 137 acres and is wholly forested. The other is known as Rappengraben. Its area is 172 acres and it is only about one-third forested. Sperbelgraben lies within the watershed of the Kurzeneigrabens and Rappengraben within the watershed of the Hornbach, both of which flow into the great Emme, and the experiment is known as the Emmental Experiment.

Of the two watersheds selected by the Forest Service in the Rocky Mountains one is 223 acres and the other is 212 acres, somewhat larger than the Swiss watersheds. The comparison between the forested and poorly forested watersheds in Switzerland was begun at once. In our experiment the two watersheds had originally about the same forest cover. The observations upon the behavior of the streams in the two watersheds were continued for nearly 9 years without any change in the cover. Last summer one of the watersheds was denuded and from now on observations will be conducted on the streams of which one rises in a forested watershed and the other in a completely denuded watershed except for a fringe of trees left along the stream.

The mountain range of Hinterarni, which in the peak Farnli reaches an elevation of 4,135 feet above sea level, lies between the two Swiss watersheds. The distance between the two watersheds where they are nearest together is 2.4 kilometers in an air line. Both valleys trend northeast to southwest. The small tributaries which enter the main stream on the left have in Sperbelgraben a north to northwest exposure, on the right a south to southeast exposure.

The altitude of our watersheds in the Rocky Mountains is much higher. One of the watersheds has an altitude of from 9,375 to 11,360 feet, while the other lies between an elevation of 9,240 and 10,940 feet. Both streams in the Rocky Mountain watersheds have an easterly bearing flowing out of the mountains on to the broad bottom of the Rio Grande where, except at the highest stage, they disappear into the loose soil of the river bottom. With regard to exposure and geological structure, the two watersheds in Switzerland, just as our own watersheds, bear a close resemblance to each other. The rock is the same in the two Swiss experiment stations and is only slightly permeable. No losses of water through its disappearance in deep-lying clefts were discovered.

The zero of the stream gaging apparatus in Sperbelgraben is 911.98 meters above sea level. The streams are of practically the same length in both watersheds—3,617 and 3,851 feet, respectively, and the gradient is steeper on the forested than on the poorly forested watershed. The visible lengths of our streams are 3,400 and 2,300 feet, respectively. The basin of Sperbelgraben is in the form of a long and narrow valley while Rappengraben is more in the nature of a deep kettle-shaped basin.

Complete meteorological observations were made at two control stations, one in each watershed, and the precipitation was measured at two additional places in each basin, hence the precipitation depends upon measurements at three points in each basin. Streamflow was automatically recorded at each of the two control stations, except during the cold season. The mean temperature and the total precipitation by months is shown in the following table to which has been added, for comparative purposes, similar data for Wagon Wheel Gap, Colo.

Monthly Mean Temperature and Total Precipitation at Sperbelgraben, 894 Meters.

[Wagon Wheel Gap, Colo., added for comparison, 2,930 meters]

*Monthly Mean Temperature F°
Sperbelgraben.*

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
27.7	29.7	34.3	40.8	49.5	55.2	57.9	57.9	51.6	44.9	35.4	32.2	43.2

Monthly Mean Temperature Wagon Wheel Gap, Colo. (at Control Station)

15.6	17.7	24.3	32.4	41.3	51.1	53.6	51.8	45.5	35.9	24.8	14.7
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Sperbelgraben Warmer than Wagon Wheel Gap by—

+12.1	+12.0	+10.0	+8.4	+8.2	+4.1	+4.3	+6.1	+6.1	+9.0	+10.6	+17.5
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Mean Precipitation (inches), Sperbelgraben

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
3.82	3.57	5.06	5.12	6.23	7.45	6.92	6.67	5.01	3.66	4.57	4.43	62.51

Mean Precipitation (inches), Wagon Wheel Gap

1.12	1.43	1.34	1.60	1.64	1.99	1.03	1.30	3.64	2.39	1.95	1.96	21.39
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Generally speaking, the climate of the Swiss watersheds may be classed as moderately cold and rainy; the climate of our Rocky Mountains watersheds as very cold and dry; most of the precipitation coming in the form of snow. The temperature of the control station in Rappengraben is lower than that of Sperbelgraben. Precipitation is practically the same in both basins, if anything, it is greater on Rappengraben. Evaporation is probably greatest in Rappengraben on account of its free exposure to the sun and winds. Thawing weather occurs in winter in spite of the elevation. Föhn winds seldom occur. The snow does not accumulate as in the Rocky Mountains of the United States.

The records of the discharge of the streams are available for the open season April 16 to November 30 of each year. Our discharge records cover the entire year. It appears that the automatic water stage recorders at the Swiss station could not be made to function with temperatures below freezing. It would seem, therefore, that the published discharge values in per cent of the precipitation are too high. Doubtless it was impracticable to make allowance for the ground water in the watershed at the beginning of the open season. This view is confirmed by computing the percentage of runoff for April. The computed percentages from the data in Table 11† is, Sperbelgraben 103.2, Rappengraben 111.9. Occasionally the entries in this table for certain months greatly exceed 100 per cent, thus Sperbelgraben, April, 1915, 258.4 per cent; Rappengraben, April, 1915, 205.7 per cent. This seems to show that a considerable part of the discharge as published was due to precipitation which had occurred in March prior to the beginning of streamflow records.

The disposition of the precipitation is as follows:

	<i>Sperbelgraben</i> <i>Per cent of precipitation</i>	<i>Rappengraben</i> <i>Per cent of precipitation</i>
Runoff	59.3	61.9
Evaporation (vegetation)	14.5	11.8
Evaporation (transpiration)	18.9	8.1
Evaporation (earth)	7.3	18.2
	<hr/> 100.0	<hr/> 100.0

In this connection the author remarks that "Since on the basis of our investigations we have come to the conclusion that for mountain districts of like form, like topography and climate, the yearly runoff from the forested and non-forested areas in our rainy lower Alps is approximately equally great, therefore, we may be permitted to assume

that, expressed in round numbers, the proportionate amount of the yearly precipitation in forested and non-forested areas which constitute runoff and evaporation, respectively, are as follows:

	<i>In Forest</i> <i>Per cent of precipitation</i>	<i>In Open</i> <i>Per cent of precipitation</i>
Runoff	60	60
Evaporation (vegetation)	15	10
Evaporation (earth surface)	5	24
Transpiration	20	6
	<hr/> 100	<hr/> 100

The results of the Emmental experiments are, of course, strictly applicable only to regions with similar climatic and soil conditions. The analysis, however, of the factors which determine the run-off on forested and open soils, as well as the manner in which the experiments were conducted, place the results on a general scientific basis. Many of the conclusions drawn by Dr. Engler may be regarded as generally applicable, while other deductions must not be generalized. There are so many factors working together in various ways in affecting the regimen of a stream that it is essential to guard against careless application of the Swiss results to all cases. Careful consideration of the factors of climate and soil and their relation to the vegetation of forest and open land will, however, be the best safeguard against false conclusions. The climatic, orographic and soil conditions on the two parallel watersheds in the Rocky Mountains at Wagon Wheel Gap are very different, the actual comparison of a lightly forested and denuded watershed has barely begun. We must wait for the facts to develop before any conclusion can be drawn. We may state here merely the deductions based upon the observations of the Swiss watersheds which seem to be of a general application and wait for our own results to confirm or modify them before we safely adopt them for our guidance.

One general fact that has been confirmed by the Emmental experiment is that a good forest cover has a very beneficial effect upon the regime of streams in mountainous and hilly regions. To be sure, it is not always possible for the forest cover to prevent floods. Under certain conditions, the forest soil may lose its retaining power entirely, as for instance, during heavy general rains, so that as much water will run off from forest soil as from open land. But even in such cases the favorable effect of a soil under forest cover on the run-off is still clearly noticeable. Thus while landslides occurred almost regularly in general rains on the steep meadow or pasture land or on bare land, the damage from this source on the forested watershed was very rare.

Another fact confirmed in the Emmental investigation was that streams fed from a forested watershed have a more uniform discharge and carry less debris into the larger rivers to which they flow than streams coming from an unforested watershed. The more numerous and greater high water stages in streams in an unforested region during heavy rains or rapid thaw, increase erosion and carry the debris downward, where it is deposited on the alluvial cones or in the river channels and raises the river bed. That the raising of the river bed causes floods and damage to property is a well-established fact.

The Swiss experiments have conclusively shown that extensive damage from floods occurs less frequently in streams coming from forested watersheds than from the streams rising in poorly forested or treeless watersheds. There is, of course, no absolute guarantee against the power of the elements. We must be content with limiting and weakening their effects as much as possible.

The great importance of forests in hilly and mountainous regions in feeding springs has been proved beyond a doubt in the Swiss experiments.

While the total average annual discharge of the two streams measured remained about 60 per cent of the precipitation over both watersheds for the entire period of observation, their behavior after heavy rainfall of short duration, such as thunderstorms and cloudbursts, or after uniform heavy general rainfall or general rainfall of variable intensity or at the time when snow melted rapidly in spring or winter, was very different. Thus in the spring and winter with a sudden thawing of snow the highest water stage and the total amount of rainfall and run-off were considerably lower in the stream flowing from the forested watershed than in the stream from the lightly forested watershed. When the ground in the forested watershed was not frozen and was not saturated with water from previous rains, all the snow water was absorbed and the greater part of it was stored in the interstices of the soil on the forested watershed. No conditions occurred which enabled the Zurich Forest Experiment Station to determine how the stream in the forested watershed would behave were the rain to fall on solidly frozen ground as the ground in the forested watershed froze less than in the lightly forested, and when it did freeze the frost did not penetrate deep.

In heavy rainfall of short duration the retaining capacity of the soil in the forested watershed was remarkably great. The maximum amount of run-off per second in the forested watershed was only one-

third to one-half as much as that in the stream in the lightly forested watershed for the same intensity and amount of rainfall. The total flow from the forested watershed in heavy rainfall was usually only half as much as that from the lightly forested. If both watersheds had exactly the same configuration and if forest and shrub cover were entirely lacking in the lightly forested watershed, the difference of course would be still greater. The height of the water stages and the total run-off during the heavy rainfall of short duration, and this is true of all other rains, depended largely upon previous weather condition which held equally good for both watersheds.

In general heavy rains the retaining power of the forest and soil varied greatly according to the previous weather or according to the water content of the soil and the duration of the rain. When the moisture content of the soil prior to rain was great, the forest cover proved ineffective and the run-off was the same as from the lightly forested watershed. If, however, the soil was comparatively dry, the forest cover had a decided effect in reducing the amount of run-off.

In general rains of variable intensity the forest cover showed a tendency to retard the amount of run-off.

In the spring months when the snow melted and in the fall when evaporation in the open was comparatively small, the run-off from the lightly forested Rappengraben was on an average greater than from the Sperbelgraben. In summer and winter, on the other hand, more water ran off from the forested Sperbelgraben than from the lightly forested Rappengraben. In the summer months, which in that region is the season of dry and variable weather, the stream in the forested watershed was fed more abundantly, more continuously, and more uniformly, than the stream from the open watershed.

The amount of run-off per second and per day fluctuated during each season much more in the stream from the lightly forested watershed than in the stream from the completely forested watershed. As a general rule, therefore, the forest cover had a controlling influence in stabilizing and evening out the flow of water in the stream.

This effect of forest cover in stabilizing and making the streamflow more uniform is due not directly to the forest cover but to the effect which it has upon the permeability and looseness of the soil and in maintaining a uniform temperature and moisture of the air and soil. The porosity and lightness of forest soil is brought about by the protection furnished by the tree crowns, by the formation of leaf mold, and by the presence of living and dead roots and an abundant soil

fauna. The soil particles under forest cover are being continually moved and stirred up often to considerable depth. The species composing the forest, as well as the character of the stand, have a decided influence upon the degree to which forest soil is maintained in a porous and permeable condition.

Forest soil is very much more permeable to water than unprotected soil. Even on the steepest slopes forest soil absorbs the heaviest rainfall almost immediately. Soil with a dense covering of sod is very slightly permeable. On protected forest soil rain water flows off under the ground but on treeless soil, especially after heavy rain, or rapid thawing of snow, the water is discharged mostly on the surface. On steep sodded slopes the run-off was found to be the greatest. Water flows much more slowly *in* the ground than *on* it and a great part of the water does not usually run off at all but is stored in the interstices of the soil.

The whole explanation of the favorable effect of forest cover upon streamflow lies thus in the greater porosity and permeability of the forest soil.

The Emmental Experiment Station has discarded an opinion long held by many prominent investigators such as Ebermayer, Wollny, Ney, Henry, and others, that the great water retaining power of the forest soil is due mainly to the great retentive capacity of the leaf litter and moss cover. The experiments have conclusively shown that raw humus and moss cover have had a very unfavorable effect upon the water regimen. Many evidences of damage from floods in forested regions could be directly traced to accumulations of raw humus in the forest. It is true that raw humus and moss absorb large quantities of water but give off very little of it to the soil, and when once saturated they cause the rainfall to flow off on the surface. It was found that on a thick cover of pine needles and deep leaf litter, the rain water ran off very rapidly on slopes of any steepness. In a period of drouth, on the other hand, raw humus and moss cover did not permit light rainfall to reach the ground at all. On a whole, raw humus and moss cover act upon the regime of streams like peat and moor soils.

The moisture content of the soil under forest cover and in the open follows different courses. In the open the soil because of its greater compactness, contains a greater amount of capillary water than forest soil. The forest soil, on the other hand, contains much more ground water. The moisture content of the superficial layers of the unpro-

tected soil varied more in the course of a year than in the protected soil. After prolonged drouth the ground water in both forest soil and open soil may be the same but the moisture content of the superficial layers is greater in forest soil than in open soils. This is due to the fact that in forest soils the loss of water from the surface is being replaced by ground water, while in open soils no such reservoir exists.

The stream of the Rappengraben watershed carried more deposit than the stream from the forested watershed. This deposit came from landslides and from erosion in the gullies. No avalanches of sand or stone occurred during the time of observation in the forested watershed, while they did occur in the partially forested watershed.

Such in brief are the deductions made on the basis of many years of careful measurement and observations of one forested and another unforested watershed.

R. Z.

Growth and Form of Trees. Tropismen und exzentrisches Dickenwachstum der Bäume. Ein Beitrag zur Physiologie und Morphologie der Holzgewächse. Engler, Arnold. Schr. Stift. Schnyder von Wartensee, Zürich. 21:1-106, Figs. 1-30, Tables 1-43, 1918.

Nouvelles recherches sur l'accroissement en épaisseur des arbres. Essai d'une théorie physiologique de leur croissance concentrique et excentrique. Jaccard, Paul. Pub. Foundation Schnyder von Wartensee, Zurich. 23:1-XIII, 1-200, Pls 1-32, Figs. 1-175, Tables 1-23, 1919.

The Schnyder von Wartensee prize essays afford an interesting sidelight upon Swiss neutrality during the late war. In 1913 the Wartensee Foundation opened a competition of three years duration to stimulate new investigations upon the growth in thickness of trees. First prizes subsequently were awarded to Arnold Engler for an essay in German, and to Paul Jaccard for a memoir in French.

Engler concerns himself with the effects of geotropic and heliotropic stimuli upon the growth, structure, and form of conifers and dicotyledons. He reaches the striking conclusion that stout, rigid stems—as well as young, flexible shoots—of dicotyls may develop marked geotropic and heliotropic curvatures, but holds that in conifers, heliotropic bending is confined to the younger and more pliable portions of the stem. As evidence in favor of these views Engler cites the crooked or curved stems of trees growing under peculiar environmental conditions, that is, on steep slopes, displaced from the normal, vertical position, in unilateral illumination, etc. He considers that on steep slopes

the terminal shoots of dicotyls, particularly during the earlier stages of ontogeny, tend to bend down-hill toward more intensive illumination upon that side. Later these curvatures are more or less completely neutralized by bending in opposite direction in response to geotropic stimuli. Eccentric growth upon the up-hill side is assumed to be due to geotropic stimuli, regardless of whether the stem is concave or convex, and eccentricity upon the down-hill side, as in conifers, to longitudinal compression of the cambial layer. He reaches similar conclusions in regard to the eccentricities of stems and branches of trees growing upon level ground. In dicotyls, the influence of gravity usually exceeds that of longitudinal compression, and accelerated growth of the under sides of stems and branches is found only where it is not inhibited by negative geotropism. Lateral eccentricity occurs when these two factors, working in opposition, neutralize each other. Longitudinal compression affects the volume of secondary xylem but not its structure. In ring-porous dicotyls "geotropic wood" is characterized by wider vessels and a relatively greater proportion of summerwood; but in different diffuse-porous species the wood of the upper and lower sides of stems and branches is of the same general type. Engler suggests that the rapid bending of stout stems in response to heliotropic stimuli is produced by the activity of living cells in the sapwood. If this is so the structure of the stem must be considerably modified. No conclusive evidence is presented, however, to prove that such structural modifications actually occur.

The first twelve chapters of Jaccard's memoir are devoted to a criticism of the Schwendener-Metzger hypothesis, which holds that the form of trees is determined largely by mechanical factors (wind and gravity), and to an exposition of his own theory that the "clear length" of the stem is, at successive heights, a shaft of equal water-conducting capacity. The three succeeding chapters, pages 101-169, are concerned with interesting experiments, designed to test the effects of mechanical, geotropic and heliotropic stimuli and various types of girdling upon the form and anatomical structure of Conifers and Dicotyledons. A large number of young stems and branches were subjected to various types of flexures (sustained or intermittent). Their subsequent growth, form and structure were found to vary depending upon the intensity and duration of the stimuli. Thus, if the stem of an erect conifer is bent alternately to the north and south no "red-wood" is formed unless the stem is allowed to remain in each posture

for a certain period of time. Again a slight curvature may accelerate the growth on the upper side of a dicotyledonous stem, whereas a more pronounced bend may produce excentricity upon the under side or inhibit the growth of both the upper and lower sides and lead to lateral excentricity.

In the fifth and concluding section of the volume, Jaccard elaborates the following hypothesis: "The morphological characters common to all trees are determined (1) by the polarity of their organs, that is to say, by their tendency to grow most rapidly in a vertical direction, and (2) by the modifications which the exigencies of nutrition and the action of external forces (gravity, heat, light) impress upon the polarity. These modifications manifest themselves through the osmotic force of cells which engenders, on the one hand, two circulatory currents (the ascending sap and descending current of elaborated substances) and, on the other hand, mechanical strains and stresses (pressure of turgescence) capable of influencing the form of cells. In general, such variations in gross form and anatomical structure—as may be observed at different levels in the concentric, vertical axes of trees—are determined by the physical conditions of the transpiration stream and the flow of elaborated sap. On the contrary, the anatomical differentiation and variations in transverse sections, which are concomitants of the excentric growth of inclined or horizontal branches, are due to mechanical forces engendered by the unequally rapid growth of the antagonistic sides of these organs, under the asymmetrical influence of gravity and light."

I. W. BAILEY.

New Zealand Forestry, Part I. Kauri Forests and Forests of the North and Forest Management. By D. E. Hutchins, I. F. S., 1919.

The pressure for "popular" writing, to stir up an interest in forest matters, is by no means confined to the United States. It is, however, to be regretted that a man of the reputation and ability of Mr. Hutchins has found it necessary to publish what is obviously a hastily written book on his observations in the forests of New Zealand, without specific data and without even verifying data applicable to other countries to which he refers. It can not be doubted that conditions in New Zealand in 1918 called for radical action and doubtless Mr. Hutchins' book on the Kauri forests served a very useful purpose in securing the progressive action which has been taken since it was written. It is, however, a curious mixture of appeals to local pride

and denunciations of the inertia with which New Zealand has watched the serious depletion of her Kauri forests. There can be less criticism of the material of this character, however, than of the strikingly insufficient observations and the almost complete lack of definite data on which the glowing picture of the future is based, with the trumpet call for New Zealand to undertake forestry under the promise of securing wonderful results. In short, the book is something which is undoubtedly useful in the New Zealand forestry movement, but it will hardly live in the literature of forestry as a reference book. With the establishment of a "technical, nonpolitical forest department on the lines of the American Forest Service," which Mr. Hutchins urges for New Zealand, we can expect publications far better from the technical viewpoint but possibly not more useful as propaganda.

E.

Jack Pine. By William Dent Sterrett, Forest Examiner, U. S. Department of Agriculture Bulletin 820, May 22, 1920.

When Sterrett writes a monograph on a tree, one can expect absolute honesty, complete absence of bluff, and painstaking care throughout. These expectations are fully realized in his latest work on jack pine. It is a careful compilation and office analysis of data on this minor species. Unquestionably it is useful and will probably stand as the standard reference work on the subject for many years. Since some of the data now published for the first time was collected as far back as 1901, the bulletin shows the value of having a central agency where data may be allowed to accumulate until it can be compiled and analyzed.

An outstanding feature of this bulletin is the inclusion of Professor Roth's basis of site classification, with jack pine as a standard C species. Apparently this method of handling a vexatious problem works well in this case, but is the Forest Service committed to following the Roth classification for all species, or is this case only a trial on a convenient dog?

This monograph is useful but it is a compilation and has consequently the weaknesses of a compilation. With his usual uncompromising honesty, Sterrett has listed in the appendix and has indicated by copious footnotes the sources of his data and the authorities for his statements. One wonders whether Sterrett himself has ever worked in jack pine until in the appendix a statement is discovered

that the author secured measurements on 12 plots in Wisconsin in 1917. The bulletin can hardly be read without a growing conviction that the author is not very familiar with his species in its native habitat and has few profound convictions based on personal observation. Possibly, as a reference book the bulletin is all the better for this. On the other hand, we miss attempts at explanation of differences in regional development, in growth, in tree form, etc., which are brought out by quotations from the wide correspondence which accompanied the preparation of this bulletin. Surely some of these apparent inconsistencies would have been removed had Sterrett been given the opportunity for thorough field study. That his compilation and analysis is as good as it is, under the circumstances, is remarkable. We hope, however, that his next bulletin will reflect much more individual field work.

The bulletin is marred somewhat by the blue pencil deletion of an unimportant paragraph discussing direct seeding and by some rather careless proof-reading, such as the leaving out of important words in the headings of Tables 30 and 31. We also note that a remarkable statement passed that mysterious despot, the Editor, who must have nodded at the time, "In lodgepole pine the cones are lateral; that is, they *grow* on the sides of the larger twigs." E.

Impressions of Theodore Roosevelt. By Lawrence F. Abbott, Doubleday, Page & Co., Garden City, N. Y., 1919. Pp. 1-315.

While not strictly a subject for review in the JOURNAL, any book dealing with the life of Theodore Roosevelt commands the interest and attention of foresters. These impressions of the great conservationist are particularly interesting, coming from the pen of an intimate friend, the son of Dr. Lyman Abbott.

It is in Chapter IV that foresters will find an accurate account of the inception and development of the great conservation movement, pages 122 to 126.

Most interesting of all is Roosevelt's own statement (page 194) of how he came to take up "the cause of conservation." "From the outset," he says, "we had in view, not only the preservation of natural resources, but the prevention of monopoly in natural resources, so that they should inhere in the people as a whole."

There is not time to review other matters dealt with in this charming book. No one can read it without a deepened conviction of Roosevelt's greatness.

A. B. R..

PERIODICAL LITERATURE

SOIL, WATER, AND CLIMATE

Weaver and Mogensen of the University of Nebraska have studied the transpiration rates of *Transpiration of Tree Seedlings* forest seedlings with the purpose, as they state, "of obtaining data on the relative losses in summer and winter of conifers and broad-leaves, and also to make a beginning on the problem of winter killing of trees and shrubs."

The tests comprise 6 species of conifers represented by 70 individuals, and 3 species of broad-leaves represented 30 individuals. The plants were grown in galvanized iron pots sealed with a mixture of paraffin and petrolatum. In order to maintain natural temperature conditions, the pots were placed inside of slightly larger pots or "collars" sunken in the soil and covered with heavy woolen blankets which were in turn covered with waterproofed muslin. Leaf areas were determined for conifers as well as broadleaves.

During the mid-summer period, July 20-August 15, the broadleaved seedlings transpired about twice as fast as the conifers; but during the autumn, September 24-October 10, there was no appreciable difference. All species showed a steady decline with the approach of winter until in mid-winter the loss per plant for an entire month was, in most cases, less than a gram. Table 2 gives the total loss for western yellow pine by periods during winter and spring and Table 9 gives the comparative loss for different species in autumn.

TABLE 2.—*Total amount (in gm.) of water transpired by 3-year-old yellow pines from January 1 to May 2, 1918.*

Plant	Jan. 1- Feb. 7 (37 days)	Feb. 7- March 13 (34 days)	March 13- March 26 (13 days)	March 26- April 28 (34 days)	March 26- May 2 (37 days)
1	2.0	13.7	8.8	7.3	....
2	0.5	....	12.2	16.5	....
3	2.5	9.5	11.0	13.5	....
4	1.5	8.0	14.5	....	69.0
5	1.5	7.0	16.1	....	70.0
6	0.5	10.2	13.8	....	26.0
7	0.5	4.5	....	....	....
8	0.5	13.1	23.9	....	91.4

TABLE 9.—*Comparative transpiration losses from unit areas of surface of broad-leaved and evergreen trees.*

Species	No. of trees	Time	Average loss per sq. dm. per day
<i>Acer saccharinum</i>	9	September 24-October 5	2.66
<i>Ulmus americana</i>	9	September 24-October 5	3.56
<i>Quercus macrocarpa</i>	7	September 24-October 3	5.18
<i>Picea engelmanni</i>	3	September 28-October 10	4.18
<i>Abies grandis</i> (2 years old)	3	September 27-October 10	5.44
<i>Abies grandis</i> (3 years old)	2	September 28-October 11	4.76
<i>Pinus ponderosa</i>	3	September 24-October 5	4.20
<i>Pinus banksiana</i>	3	September 26-October 10	4.80

Abies grandis, *pinus murrayana* and *acer saccharinum* (6 out of 12) are recorded as winter killed. *Pinus ponderosa*, *Picea engelmanni*, and *Pseudotsuga mucronata* (*taxifolia*) lost some or all of their leaves, but resumed growth the following spring.

The following is quoted from the conclusions :

"A consideration of the foregoing data leads us to some conclusions quite the converse of statements generally current in ecological-physiological literature. Perhaps the most important of these are the facts shown to hold under the conditions of these experiments; first, that broadleaved trees under late summer conditions have no greater and indeed often a smaller transpiring power, area for area, than conifers; and secondly, that the water losses of coniferous trees during the winter months are relatively no greater with the needles intact than are the losses from deciduous trees after the leaves have fallen.

* * * * * * *

"That winter losses from the same leaves that transpired so freely the preceding fall and again in the following spring are so small is certainly testimony of the ecological efficiency of coniferous leaf structure for reducing water losses. Whether this is due entirely to stomatal closure, or, as seems more probable, is connected with chemical changes in cell contents as well, remains to be determined. Such work as that of Miyake (15) on the food making of coniferous leaves in winter and Ehlers (5) on temperature is rapidly throwing considerable light upon the winter activities of coniferous trees."

By way of comparison, it is of interest to cite the results of experiments with conifers at the Fort Valley Experiment Station during the winter of 1919-1920. Sealed pots containing *Pinus ponderosa*, var. *scopulorum*, *Pinus aristata*, *Picea engelmanni* and *Pseudotsuga taxifolia* were kept imbedded in snow and ice throughout the winter, with the primary object of ascertaining the relative susceptibility of different species to winter killing. Transpiration data for the entire period

are not available, but it was determined that considerable water loss takes place on sunny days which often occur during midwinter in this region. For example, from February 24 to February 28, 1920, the loss per plant (3-4 year-old transplants) was as follows: *Pinus ponderosa*, var. *scopulorum* 3 grams, *Pinus aristata* 2.7 grams, *Pseudotsuga taxifolia* 7 grams, *Picea engelmanni* 6.3 grams. The soil in the pots was frozen solid excepting that in the afternoons it thawed to a depth of two or three inches. At the present writing, April 5, 1920, one of the yellow pines is dead, and the remaining three, though apparently alive, have many dead needles; Douglas fir and Engelmann spruce are all alive but have a few dead needles (the tip of one Douglas fir is dead); bristle cone pine shows least injury of all and appears practically normal. Since in average years the soil to a depth of two feet remains frozen during continuous periods of thirty to ninety days in this region, and during these periods clear weather may prevail during continuous intervals of ten days or more, winter killing is to be expected. The fact that relatively little winter killing actually does occur is attributed to the fact that the ground throughout the winter is usually covered with from two to four feet of snow which protects small seedlings from transpiration.

This investigation by Weaver and Mogensen adds in no small way to the existing knowledge of conditions relating to the early establishment of forest trees. Unfortunately but few ecological investigations carried on by college professors are more than very remotely applicable to forest problems, and therefore such contributions as the present one will always be welcomed by forest research workers. G. A. P.

Weaver, J. E. and Mogensen, A. *Relative Transpiration of Coniferous and Broad-leaved Trees in Autumn and Winter*. (With 18 figures.) Botanical Gazette, Vol. LXVIII, No. 6, December, 1919.

SILVICULTURE, PROTECTION, AND EXTENSION

H. G. Champion describes in considerable detail the effect of the disastrous season of 1916 on the chir pine in the West Almora forests.

Since the chir pine is very similar to our western yellow pine, the results of this study are of interest, especially to those who are combatting the dangerous propaganda of "light burning." A digest of Champion's conclusions is as follows:

1. Even large chir pine trees cannot withstand fire damage and trees up to two feet and more in diameter were killed outright. All trees were not killed immediately, but "more and more trees have died each month, much as they sometimes do around a lightning struck tree;" and he states further, "it becomes a very difficult matter to tell even after careful inspection soon after the fire, what the extent of the damage will be." . . . The trees tapped for resin were especially damaged and the production of resin was largely diminished.

2. Real crown fires occurred in the smaller timber, up to thirty feet in height. The damage was practically complete. Seedlings suffer complete loss and, according to Champion, "I doubt if a one season old seedling ever survives a fire" and but few two; some three or four season seedlings survive, but those that do survive are greatly weakened. This would tend to prove that light burning in pine forests is out of the question from a strictly forestry standpoint.

4. Broadleaved trees: Successful fire protection means an increase in the percentage of broadleaf timber.

5. Herbaceous vegetation. Champion explodes the widespread belief that annual firing improves the grass crop. T. S. W. JR.

Indian Forester, Vol. 45, pp. 353-364. 1919.

Damage to French Forests Dabat, Director of the French Forest Service, has given out preliminary figures on the damage to French forests during the war, and on the work required to put them in their original condition. During 1920, the French Forest Service expects to publish complete and detailed statistics on the damage done. The preliminary figures are as follows:

Area where productive capacity completely destroyed 500,000 acres: One-half of this area must be reforested and one-half cut back, or reforested. In addition 250,000 acres must be improved and the roads, trails, and boundaries put in proper shape.

There is 125,000 acres of agricultural soil, which will be unfit for agriculture and must be reforested. The work to be done is summarized as follows:

1. Of first importance: Removal of barb wire, levelling of trenches, clearing of debris, provisional repair of roads, cutting back coppice, improvement fellings, removal of damaged standards and salvaging timber left on the ground.

2. Of second importance: Reforestation of denuded areas chiefly by planting, but partly by sowing. It is expected that a great deal of plant stock and of the seed will be secured from Germany. Nurseries, however, must be established by the French Service in zones of heavy fighting where the damage is greatest.

T. S. W., JR.

Effect of Thinnings on Fir Emile Mer gives some interesting figures that show that thinnings tend to increase the growth of the larger fir trees more than the smaller trees of a stand. He makes two general conclusions: (1) Trees whose growth has fallen considerably below the average growth of the stand had best be removed (other things being equal), because they are least benefited by thinnings. (2) Thinnings in French fir stands should begin earlier, for the younger trees are most benefited. The increased growth "should largely compensate for the cost of the work."

T. S. W., JR.

Revue des Eaux et Forêts, pp. 141-146, 165-175. 1919.

Soil Maintenance Removal of leaf-litter under stands of hardwood species (beech, oak, ash), either by erosion, by wind, or otherwise, results in a hardening of the surface soil (especially on heavy soils) which is usually soon covered with a matted vegetation of *Polytrichum* or other moss. These conditions seriously affect the growth of the forest. To hold the leaf-litter in place, the smaller branches resulting from logging operations were scattered over the ground. Examination six years later showed a heavy cover of leaves, no moss, and surface soil free from crust, in sharp contrast to nearby areas not so treated.

W. N. S.

Schroder. *Bodenpflege durch Reisigdeckung*. Deutsch. Forstztg. 34:162-163. 1919.

MENSURATION, FINANCE, AND MANAGEMENT

Swiss Forests During the War Administration of the 982,000 hectares of forest lands in Switzerland, one-fourth of the total area of the country, is decentralized. Cantonal forests comprise 4 per cent of the forest area, communal forests 67 per cent, and private forests 29 per cent. There are no national forests, and the national forest service employs only 17 pro-

fessional foresters. It contributes, however, to the salaries of the cantonal forest officers; supervises the use made of subsidies granted to the cantons; administers the federal forest law; provides technical instruction at the forest school at Zurich; and directs the forest experiment station. At the outbreak of the war construction was automatically arrested and cutting materially decreased. After ten or twelve months, however, the foreign demand for timber and the native demand for wood fuel (due to the scarcity of coal), resulted in a steadily increasing cut. In 1916 wood exports, which before the war had been from 40,000,000 to 50,000,000 francs a year less than wood imports, exceeded the latter by 68,000,000 francs. The increased cut was accompanied by increased prices, fuel doubling and timber trebling in value in three years or less. Little or no overcutting took place in the public forests, but was more or less marked in the private forests, where advantage was taken of the extraordinary demand to improve the stands by the removal of many old reserves which before the war could not be marketed profitably. Strict supervision was exercised over all cuttings, a federal decree in 1917 requiring a permit for all cuttings of 20 cubic meters or more and fixing a fine of from 10 to 40 francs per cubic meter for all cuttings made without a permit. Moreover, measures were taken to maintain and if possible to increase the future productivity of the forest. For instance, in the Canton of Vaud, the number of inspectors was increased so that the average area under the supervision of each was reduced from 7,300 to 4,000 hectares. This example should be followed by other cantons as a means of increasing production and of rendering Switzerland independent of foreign supplies. An increase of only 1.1 cubic meters per hectare in the annual growth of the 600,000 hectares of communal forests would be sufficient to wipe out the present deficit of 700,000 cubic meters, but this can hardly be expected as long as the average area under the supervision of a technical forester remains as high as 8,570 hectares.

S. T. D.

Barbey, A. *Les forêts suisse pendant la guerre*. Bull. Trimest. Soc. Forestière Franche-Comté et Belfort, 13:46-51. 1919.

*Working Plans
in India*

According to "X" "The standard of working plans in India leaves much to be desired," and bad methods are very largely responsible for the poorness of plans. Some of the arguments presented are as follows:

presented are as follows:

1. Working plans should not be made by inexperienced men, but by men fully familiar with Indian silviculture—and they should be made in close collaboration with the chief conservator, when there is one.

2. Rotations and other silvicultural recommendations should be based on definite figures rather than “a compromise of nervous inexperience.”

3. Plans should omit elementary silvicultural discussions which soon are out of date and which merely lead to errors by subordinate officers.

4. The local officers in charge of a forest should supply the specialist who is to make the working plan with data on the following subjects: (1) Neighboring agricultural customs and necessities; (2) distribution and area; (3) boundaries; (4) rights and concessions; (5) statistics (references only); (6) dangers; (7) marketable products with possible new demands; (8) lines of export with suggested changes; (9) cost, method, and agency of exploitation with suggested changes; (10) current prices; (11) forest staff; (12) labor supply; (13) a miscellaneous chapter indicating any special local points which affect management. The local officer can supply these data accurately and quickly, whereas the specialist is at a disadvantage because of his lack of knowledge of local conditions and, therefore, should not be required to make original investigations on these subjects.

5. Much of the routine now done by the working plans officer should be done by subordinates and by lower salaried officials.

T. S. W., JR.

Indian Forester, Vol. 45, pp. 364-374. 1919.

Kubelka develops a “Femelstreifenschlag” (selection strip cutting), different from the system described by him under the same name in 1912, which was really only a slightly modified form of Wagner’s “Blendersaumschlag” (selection border cutting). Under the new system, the whole stand is first subjected to a preparatory cutting, then the stands are laid off in strips from 30 to 50 meters wide (height of trees) running at right angles to the direction of reproduction. In every fourth strip large and small holes are cut clean, varying from a diameter equal to the height of the trees, down to half that. The other strips are undisturbed, except for the preparatory cutting. Later the middle remaining strips are treated in the same way, then the others. As soon as reproduction is established in the openings, they are gradually enlarged. Depending on the period allowed for reproduction, the stand can be made into a practically

even-aged one, or into a conglomeration of small even-aged stands varying from each other by 60 years.

Fabricius questions some of Kubelka's conclusions as to the efficacy of his method, such as; that insect damage is greatly reduced; that danger from storms is little greater than in virgin forest. Kubelka recommended the method for general application under all conditions in the forests of central Europe, although he has only tried it on a few private forests for six years or less, and the high yields in material and money which he claims were the result of the methods he seeks to change. It is doubtful whether at this time Europe is in condition to suffer the loss in forest production which must result from transforming existing forests into small broken-up stands. W. N. S.

Fabricius. Kubelka, August. *Moderne Wirtschaft*. Vienna and Leipzig, 1918. Forstwiss. Centralbl., 41:148-152. 1919.

It is now proposed to standardize forest maps in British India, and many of the symbols suggested are of value to American foresters. It is especially interesting, therefore, to read a criticism of the proposed standard symbols and colors for forest maps written by a technical forester, because they show that forest working plans in India are further advanced than forest working plans on our National Forests in the United States.

Special boundary symbols in red are suggested for working circle, felling series, coupe and subcompartment.

Howard argues for a scheme to show the different silviculture systems in colors: Uniform system (including strip system, group system, etc.), *rose*; selection system, *yellow*; clear-cutting system, *green*; coppice with standard system, *blue*; coppice system, *gray*; improvement-felling system, *light brown*; unworked areas, *pale blue*.

The scheme for showing species is based on a diagrammatic picture of the seed of the species to be depicted, or as an alternative, the capital letter of the name of the species, as for example, capital "D" for deodar; whether the species was predominant or auxiliary would be shown by putting the symbol or key letter above or below a line.

Howard also argues for three quality classes, for a symbol to show the average age of the stand, or if irregular in age, the letters (i. r.) and a number to show the periodic block, coupe number, compartment number, and sub-compartment number. It will probably be some years before our National Forests, in the West at least, require such

an intensive map classification, but it certainly behooves the Forest Service to revise and intensify its map system for the Eastern National Forests so as to provide for more intensive working plan maps.

T. S. W., JR.

Indian Forester, Vol. 45, pp. 454-469. 1919.

The assertion frequently made that German *Wartime Cutting* forests were greatly overcut during the war is *in German Forests* not generally true. The writer cites the records for a forest under his charge, comprising 12,000 hectares, about half softwood and half hardwoods, with a stock of more than 3,300,000 cubic meters of wood and an annual cut of about 90,000 cubic meters. The actual cut during each of the four years 1915 to 1918 was less than that provided by the working plan. A table shows the annual cut for every year since 1899, and for single years as far back as 1577.

W. N. S.

Eulefeld. *Zahlen-Nachweisung aus dem Privatwald*. Forstwiss. Centralbl., 41:53-57. 1919.

UTILIZATION, MARKET, AND TECHNOLOGY.

During the war Germany was forced to secure *Resin Production* its naval stores from home sources, spruce and *of* pine, thus reviving the naval store industry. *Scotch Pine* After four years of unsystematic practice, a systematic investigation of the business and especially of the physiological factors influencing the resin flow of the pine was undertaken in the Bavarian Forest Experiment Station by Lutz Schierlinger. He reports at great length his results. We give the author's summary of those for practical application:

1. The resin yield depends in greater measure on physiological factors than on the technique of utilization.

2. Slender trees with good crowns, grown in the open, are specially fit for turpentine. Forking increases the yield capacity, abundance of cones seems to diminish it.

3. The resin ducts of the entire sapwood form a communicating system. The resin flow is most perfect in vertical direction; but also the tangential and radial flow are of great significance.

4. When the resin present below the scar, or that newly formed from the reserve materials there imbedded, is pressed out, it is replaced through resin flow exclusively from above.

5. The resin yield can be considerably increased through continual scarification if the progress is correctly made, namely, upward.

6. The weather limits the beginning and end of the yearly utilization as well as the intervals of the single harvests during the season; with favorable weather—warm but not dry—in middle and late summer a return within two or three days may be maintained; the rule is that pauses of three to four days—twice weekly—should be maintained. At the beginning and end of the period the pauses should be still longer.

7. If a large circumferential surface is scarified, as well as in the case of deep cuts, longer pauses must be made between the single cuts.

8. The more fully crowned side of the tree, more accessible to the light, is as a rule richer in resin; on leaning stems it is the upper side, which is also preferable on account of the more favorable exterior run of resin.

9. The most profitable method of scarification consists in oblique, slightly slanting, troughs which utilize half the stem circumference, beginning at the very base of the stem and progressing in as small as possible or no intervals upwards.

10. The cuts are to be made narrow and shallow. Opening of old cuts damages the total yield especially if repeated; the same holds true for the simultaneous making of several cuts above each other.

11. The best collecting is done by a flower-pot like pot fastened with a large nail and provided with a broad dropping tin.

12. If the part of the stem which can be reached without ladder has been used up and the stand is soon to come into utilization, it might be suitable to turpentine the other side of the stem. A diminished yield in the beginning is to be expected but must not deter the utilization. In this way stands are to be turpented for from four to six years; in stands which are to be cut in one or two years after the beginning of the turpenting two-thirds or three-quarters of the circumference may be turpented.

B. E. F.

Harznutzung der Fochre. Naturwissensch. Zeitschrift für Forst und Landwirtschaft. Oct.-Dec., 1919, pp. 281-365.

*Turpentine Oil
and Rosin*

During the war a method was devised by which pine lumber can be dried in three days. The process yields a considerable amount of turpentine and rosin as by-product. The total pine wood cut each year in Germany could yield some 378,000 metric tons of extract, of which about one-fourth would be oils, the rest turpentine

and rosin. The total consumption of imported pine oils by German industries amounted in 1913 to 51,000 tons, worth 39 million marks. Since spruce yields as much oil as pine, this process opens an opportunity for wood pulp manufacturers, who use both woods.

W. N. S.

Besemfelder, Eduard R. *Heimisches Terpentintöl und Harz*. Forstwiss. Centralbl., 41:49-53. 1919.

*Use of Wood
Paving Blocks
in India.*

The Indian Forest Service has announced the preliminary results of experimental wood paving in India under the adverse conditions of a hot climate and heavy rainfall. At Rangoon untreated teak and pyinkado 6 inches by 3 inches by 6 inches was *not* successful owing to "lift and blister after heavy rains." At Calcutta the experiments were more thorough and dated back to 1902. The chief engineer reported *unfavorably* owing to objectionable smell, contraction, and expansion of the blocks, and high cost. Sal was not as good as Douglas fir but "during the rains of 1916 . . . the pavement burst up in places and the blocks had to be taken out and relaid." On the contrary at Bombay the teak and jamba (*Xylia xylocarpa*) carefully laid with "a covering of tar and sand . . . to prevent excessive moisture from affecting the blocks have worn well" and therefore it may be presumed that wood paving is a proved success as far as Bombay is concerned.

T. S. W., JR.

Indian Forester, Vol. 46, pp. 28-33. 1919.

*Fir and Spruce
in India*

According to Greswell, under the stimulus of war demand, there has been an increased utilization of fir and spruce forests in Punjab and Kashmir. Beginning with 1916, the output from Punjab alone was 80,000 tons and the market price of a beam 14 feet by 12 inches by 6 inches rose to about \$32.00 per thousand board feet. With cheap river transportation, cheap labor, and a large raw supply, it would appear to the reviewer that these coniferous stands might be developed to supply considerable quantities of paper pulp.

T. S. W., JR.

Indian Forester, Vol. 45, pp. 395-397. 1919.

*Killing Trees
with Atlas
Preservative*

Contrary to the reports by A. J. Butterwick, P. F. S. A. Sanger-Davis and H. W. Moor state that tropical timber can be killed by girdling the bark (12-inch ring) and then painting with pure Atlas Preservative at the rate of one

gallon to 15 18-inch trees. Death takes place in 1 to 5 months after painting. Where merchantable trees are to be removed from fire lines in tropical climates (where girdling is unsuccessful) this use of Atlas Preservative may be of value.

T. S. W. JR.

Indian Forester, Vol. 45, pp. 547-550. 1919.

STATISTICS AND HISTORY

*Russian
Timber Exports*

In the consideration of a possible resumption of trade relations with Russia by the Allied nations and the United States, it is instructive to recall the extent of Russia's pre-war timber

exports. Before the world cataclysm of 1914 Russia occupied first place in the world in export of timber from 1910 to 1912, reaching a valuation of almost \$75,000,000. This exceeded by one and one-half times the value of timber exports from Austria-Hungary, and was 15 per cent greater than Canadian timber exports. Prof. Goldstein is authority for the statement that under a proper system of timber exploitation of its timber wealth, Russia could produce incomparably greater exports, due to the fact that its timber area is three times greater than the combined timber areas of the United States and Canada. He points out that every increase in timber prices in the world market has been followed by a more intensive forest exploitation in Russia, which naturally tended to hold the average prices of timber and its products upon a comparatively low level. With the coming of settled conditions in Russia, if they ever do come, it is believed that there will be an unexcelled opportunity there for American foresters and American logging engineers, for the reason that the conditions more closely resemble our own in that they have an enormous undeveloped area, with a scanty population, and exploitation must be carried out on a very big scale.

J. D. G.

The World's Economic Crisis and Trade with Russia. By Dr. Joseph M. Goldstein, Professor of Political Economy, Moscow Institute of Commerce and Industry and the University of Moscow. In *Struggling Russia*, April 3, 1920, p. 24.

POLITICS, EDUCATION, AND LEGISLATION

*Changes
in
Germany*

In consequence of the war and of the revolution which changed the monarchies of the various States and of the Empire into republics, various changes in forest-political and forest-technical direction have taken place.

First of all we note the creation of a National Forest Commission in October, 1919, under the name Reichsforstwirtschaftsrat, an outgrowth of the hitherto private committee of the same name of the German Foresters' Society. It consists of 77 members, namely, 20 representatives of the State Forest Service, 10 representatives of communal forests, 10 of private forests, 14 of the National Forest Owners' Association, 4 representatives of forestry science, 6 academically educated forest administrators as delegates of the German Foresters' Association, 6 underforesters, 7 forest laborers, delegates of the German Farm Labor Union. At the head of the commission is an executive committee of 3 with a standing committee of 26. It publishes regular reports of its proceedings under the title "Mittheilungen des Reichsforstwirtschaftsrates" (which can be had through J. Neumann at Neudamm).

One of the important questions discussed referred to the increased cut which for the next two years had been determined at one-third above normal. This in the Saxon and Thuringian Forests, which have a very well regulated age class condition, a rotation of 80-90 years and severe thinning practice, might lead to disaster. Nor will this excessive cut suffice for the needs. With the lost provinces there are lost 962,299 hectares of State Forest with a still larger loss of communal and corporation forests and in addition 443,500 hectares in Alsace-Lorraine. An embargo on export seems contemplated. The idea of substituting fuel-wood for the loss in coal production is considered hopeless, since the deficit in coal production of 50 million tons annually would require 200 million stere of fuelwood to replace it, while the usual production of fuelwood was only 27 million stere.

Of interest in our discussion of a national forest policy is the attitude of the commission as regards the Government's influence on private forests owners and change to State ownership. This last is to be negatived as well as a more drastic police supervision; indirect influence being advocated. Yet it is held that the utilization of the full yield capacity of the soil is no longer a private matter. Property

has obligations; its use must at the same time do service to the common good.

An interesting statement is made regarding high wood prices, which might now and then lead to devastation of small forests but on the whole form a great stimulus to correct forest management. Socialization of private forests has so far not found influential support.

The revolution which upset the monarchies and produced the republics was remarkable for its peaceful accomplishment, its considerate treatment of the monarchs, and the sanity of its proceedings in general. In Baden in the proclamation of November 22, 1918, it was declared that the Grand Duke and his family enjoy the protection of the Baden Republic for their freedom, their honor, their property and their life. As regards property the situation with reference to the State forests was unclear as to title, the question being whether they belonged to the State or the Grand Ducal family. As a result of negotiations a compromise was reached by which in lieu of the Ducal claims on the forests there were handed over to the Grand Duke, besides three castles and a capital of 8 million marks, the use of two forests. It is also interesting to note that the popular government expressed their thanks to their former ruler and his family for their understanding acceptance of the situation.

With the advent of the socialistic republic the question of socializing the forests is frequently discussed in the magazines and mostly negatived by foresters. The State forests are, of course, already socialized, that is, managed for the benefit of the community. So are the communal forests; these two categories comprising 57 per cent of the total forest area. The socialization can therefore refer only to the 43 per cent in private ownership. Of these 10 per cent are in "fidei kommiss," that is, under Government control by contract with the owners. These, as well as the larger private forests, are managed for sustained yield and produce not much less than the State and communal forests. The timberwood production of the various categories of forest is stated as follows, admitting the unreliability of the statistics regarding private forests. The data are for 1913:

<i>Festmeter per hectare</i>	<i>Workwood</i>	<i>Timberwood</i>	<i>Total wood</i>
State forests	4.4	5.1	6.4
Communal forests	2.6	3.3	4.2
Fidei kommiss forests	3.1	3.9	4.9
Free private forests	1.2	2.0	2.4

The larger part of the free private forests consists of small woodlots which could not profitably be administered by the Government. They are altogether somewhat over 67,000 units, of which not more than 173 are over 250 acres in size. Dr. Jentsch concludes that expropriation of the private forests would be economically disadvantageous and from the standpoint of administration and finance impossible. He then discusses in detail the ameliorative and promotive methods of influencing private forestry and the organization of state control.

B. E. F.

Die Stellung des Waldes und der Waldwirtschaft im Volksstaate mit besonderer Beziehung auf Sachsen. Tharandter Forstliches Jahrbuch. 1920, pp. 1-29.

Rundschau. Schweiz. Zeitschrift fuer Forstwesen, May, 1919, pp. 164-168.

Die Auseinandersetzung, etc. Forstwissenschaftl. Centralblatt. 1919, pp. 308-309.

The fourth tri-annual meeting of the Board
Forest Policy of Forestry held at Dehra Dun in 1919, dis-
in cussed at some length the administrative organ-
British India ization policy and technical work of the depart-
 ment. The following is of especial interest to

American foresters:

1. A special forest engineering branch was advocated in order to assist in utilizing the forest resources of India. There must be a closer relationship between the business men of India and the Indian Forest Service.

2. In line with the fight in India by the native population for a larger share in administration, Sir Claude Hill, a member of the Indian Council, announced: "I know that you will all agree with me that in this matter the Forest Service and the Forest Administration, which we are developing for the benefit of India at large, should be shared with Indian gentlemen of the right stamp."

3. Sir Claude Hill also emphasized the need for spending more money on research, more money on silviculture so that the scientific development of forestry in India will be more rapid, and "that efforts must be made to increase the present low return from Indian forest areas to correspond more favorably with the high returns received per acre from European forests."

4. The Inspector General of Indian Forests, Mr. G. S. Hart, spoke of securing American forest engineers to assist in forest engineering problems (two Americans have already left for India to undertake

this work). He referred to the decentralization of training of forest rangers, now a fixed policy in British India. He also emphasized the fact "that Indian forests are not subject to insect epidemics under normal conditions, but conditions favorable for epidemics and the evolution of new primary pests may be created by the establishment of pure plantations and uniform forests." It was of interest to learn that since 1910 293 permanent sample plots and 74 temporary plots have been laid out and measured. The object of these plots "is to ascertain the rate of growth, volume production, and intermediate yields of typical forest growths of different kinds."

Contrary to the policy in the United States, Hart announced that instead of publishing monographs on the principal Indian species, they had decided to bring out a complete book dealing (from a silvicultural point of view) with the principal and secondary Indian species. From an economic standpoint Hart emphasized the development of match manufacture, treatment of ties, inquiry in regard to paper pulp from bamboos and grasses, pencil making, wood paving blocks, and new uses of Indian timbers.

According to Hart, "the resin industry in the United Provinces and the Punjab has been steadily expanded, and though it has not yet reached anything approaching its full possibility, now yields a gross revenue of over *five million dollars*." It will be interesting to see whether the development of this industry permanently damages the chir pine.

Another question raised by Hart was the proposed change from the selection system to what he calls the uniform system, in order to secure the largest possible yield from Indian forests in accordance with European methods. This will mean much more artificial regeneration and will carry with it the obligation for more intensive improvement work. It seems to the reviewer that the abandonment of the selection system in teak forests, for example, may not be entirely successful.

T. S. W., JR.

Indian Forester, Vol. 45, pp. 271-304. 1919.

A comprehensive forest policy should include both a far-sighted administrative program and legislation necessary to make this program effective. The essence of such a policy can be expressed by the simple motto, "To create and to conserve." The State should take the lead in creating, not by the purchase of private lands already for-

*A Motto of
Forest Policy*

ested, but by the acquisition and reforestation, chiefly with native conifers, of lands now uncultivated or abandoned. These plantations, scattered throughout the country, would not only prove profitable financially, but would prove more effective in stimulating similar work on the part of other owners than any amount of literary propaganda. Reforestation by communities should be further encouraged by State loans, and the resulting plantations should be subject to the forest regime. Private owners and forestry societies should be given free advice and other assistance by the State, and plantations established by them should be granted liberal exemptions from taxation until they reach a certain height.

The conservation of privately owned forests, which constitute more than two-thirds of the forest area of France, is a matter of very real public concern and should therefore be undertaken by the State. Supervision of cuttings in such forests should be exercised by the State, without charge to the owner; while clear cuttings in protection forests should be prohibited, and in other forests should be followed by reforestation. As to clearings, legislation should be enacted providing that the forest area of France must not be diminished; prohibiting the clearing of all stands in the zone of protection forests; and requiring a permit from the Minister of Agriculture for the clearing of all stands outside of this zone. These measures would require an increased forest personnel, which could be secured in part by relieving forest officers of their duties as fish wardens. Supervision of private cuttings could also be facilitated by commissioning private forest guards as forest officers. Finally, conservation should be promoted by giving forest owners, both public and private, more adequate protection against trespass by increased penalties. S. T. D.

Raux, Marcel. *Une devise de politique forestière*. Rev. Eaux et Forêts, 57:248-254, 261-274. 1919.

The following budget of the Prussian Forest Administration for the year 1919 refers to an area of 7,538,667 acres. The data may be compared with those given for 1913, before the war, in volume 11 at page 441, and those of 1916, in the midst of the war, given in volume 9 at page 377. The yield of wood was planned to be, in 1919, 400,716,000 cubic feet, of which 327,452,000 is capable of control. The ordinary income is estimated

at \$62,140,000 (normal exchange). The permanent expenditures amount to \$20,357,000. Extraordinary expenditures add \$121,000, making the total surplus around \$44,000,000. This makes an average net income of \$5.82 per acre, as against \$2.61 in 1913, and \$4 in 1918. Receipts from wood alone amount to \$56,120,000. Cost of administration for personnel is \$6,188,000. Other administration costs are around \$12,000,000. For schools and research \$95,200 approximately. The number of officials totals 6,500 men, namely, 33 Oberforstmeister, 85 Forstraete (inspectors), 822 Oberforsters (supervisors), 111 financial agents, 5,400 under foresters, 45 forest guards, and 13 others. Logging costs are estimated at \$8,330,000, which is \$2,213,000 more than the year before.

B. E. F.

Der Haushalt der Preussischen Forstverwaltung für das Rechnungsjahr 1919. Forstwissenschaftliches Centralblatt, Heft 8 and 9, 1919, pages 327-331.

MISCELLANEOUS

*Tubeuf's Visit
to the
United States*

In 1913 von Tubeuf of the University of Munich made a trip through the various forest regions of North American. His "Descriptions and Pictures from North American Forests" in periodical form began in 1916 and have now

been completed.

It is always interesting and instructive "to see ourselves as others see us." So as we turn the pages of Tubeuf's story we find that what is commonplace to us impresses him strongly, and that to which we point with pride he often views with disapproval.

For the most part his narrative is appreciative rather than critical. He begins with the Eastern Seaboard and then works his way slowly westward. In his installment entitled "From Chicago to the Rocky Mountains," we find him describing the Prairies, Great Plains, and the Dry Land Experiment Station of Nebraska University. He seems to have been particularly impressed with travel by Ford "at a frenzied pace" and the frame houses with porch and the inevitable rocking chair.

Next he describes the coniferous forests of the Rocky Mountains, which he reached at Colorado Springs. He climbed Pikes Peak and is impressed with the lack of animal life excepting the chipmunks.

He then, at considerable length, develops his observations as to the occurrence of two different forms of Douglas fir, which he believes

should be made separate species. The *blue* Douglas fir, which Tubeuf suggests be called *Pseudotsuga glauca*, occurs especially in the more arid portions of New Mexico, Arizona, Colorado, and northward to Montana and British Columbia. The *green* Douglas fir, which Tubeuf suggests be called *Pseudotsuga douglasii*, occurs especially in the moister regions from the island of Vancouver, in British Columbia, southward through the Cascades and Sierra Nevada, as well as along the Coast.

The *blue*, he claims, is a mountain variety; the *green* a lowland variety. The former is pyramidal in shape; the latter broad-crowned. The *blue* is slow growing and frost-hardy; the green is of rapid growth but susceptible to frost.

This form of species-mongering is to be strongly deprecated. It has been carried *ad nauseam* by Sargent in the case of *Crataegus* and others of less prominence have followed suit, until confusion in the field of dendrology has become worse confounded. As Wiebecke once said: "The botanists also have names for this tree." No, there is only one Douglas fir and its scientific name (*O! patientia nostra*) is *Pseudotsuga taxifolia*. If we change it at all, let us call it *Douglasia americana* or some such sensible name.

Tempted by the blue and the green Douglas fir, Tubeuf next addresses himself to proving (to his own if not to our satisfaction) that the variety of western yellow pine, which occurs in the foothills of the eastern and the southern Rockies, is a separate species—*Pinus scopulorum*. This merits the same criticism as the attempt to differentiate two species of Douglas fir.

Much of what follows is a description of different kinds of mistletoe on western conifers. On this subject Tubeuf is an acknowledged authority.

Tubeuf makes this interesting observation: "It struck me that in the hot and arid regions, very many of the woody plants have a smooth, white, light-reflecting bark, and that in such regions the blue-white color of the needles of conifers is very marked. Such bark and needles decrease the heat-absorption and, in the case of the needles, also decreases the evaporation, in opposition to the effect of the sun, which always produces strong heating and strong evaporation at the same time."

Tubeuf speaks a good word for the Fremont Experiment Station, which he visited.

The last installment (to date) is an enthusiastic description of Tubeuf's trip from Denver over "Moffatt Road" to the Arapaho Forest, where he saw the lodgepole pine in its glory. The young stands on old burns, he says, "simply clamor for thinnings. But who is there to do it? The ranger has no control over the choppers; he does not direct the cutting. The sale of the wood is on the stump, to a dealer who uses the best material and leaves the rest. Nature does the re-seeding. This is the usual sequence and is the chief difference from German forest management."

A. B. R.

Schilderungen und Bilder aus Nordamerikanischen Wäldern. C. von Tubeuf. *Naturwissenschaftliche Zeitschrift.* 14:513-540; 1916. 17:1-44, 153-166; 1919.

EDITORIAL COMMENT

THE SOCIETY VOTES FOR NATIONAL CONTROL

The Society, by a large majority, voted in favor of practically all of the provisions of the report of the Committee for the Application of Forestry. This referendum vote is of interest from several stand-points.

The activities of most of the members are outside of Washington. They deal with State and local problems. Their vote, therefore, in favor of National control must reflect largely their personal experience in meeting local problems.

At first sight the total number of those voting seems rather small. In the past the Society has cast its largest votes for President, and in comparison to those we find that the ballot for the report is 33 below the average total votes cast for President during the past three years. It is greater than the total cast for President in 1918, less than that cast in 1919. The Society has never polled a vote greater than 60 per cent of its total voting membership, and it reached that percentage only once. The average total vote has run along between 40 and 50 per cent of the total membership. The vote might have been somewhat larger, no doubt, had it been taken at some other time of the year, for in the middle of the field season it is manifestly difficult to bring out the largest possible ballot.

A small but distinctly audible group of members expressed regret that the report was not voted upon, *yes* or *no*, as a whole. Such action would have been at variance with the wishes of those present at the last annual meeting, when a motion was introduced by Col. Greeley, seconded by R. S. Kellogg, and favorably acted upon calling for a ballot clause by clause. Moreover, and what is more to the point, no one, not even the Committee itself, considered the program then framed as a final plan which should be advocated without change. The report was made, primarily, to obtain the views of the Society upon certain big, clearly defined principles. These views have been obtained, and the results are definite.

Quite regardless of the result of the ballot, the Committee is to be congratulated upon having instilled new life into the Society as a

whole. It has succeeded in stirring up a lively discussion upon a subject of immediate public importance and, aided by the campaign of the Forest Service to the same end, has impelled the Society to take an active stand in a matter of concern not only to the Nation, but also to the profession itself.

We are glad, too, that the Committee has pursued its work in a dignified way, trusting to facts and straightforward arguments to carry home its points; and this in the face of frequent ridicule from the lumber industry, which regarded the Committee as a sort of "lunatic fringe" of the profession. This fringe, incidentally, appears to have spread toward the center.

REPORT OF THE FORESTRY COMMITTEE OF THE EASTERN SHOOK AND WOODEN BOX ASSOCIATION .

The Eastern Shook and Wooden Box Manufacturers' Association is one of the few associations of wood-users to concern itself with the problem of wood shortage. This organization, which covers the New England field, has made a careful study of the situation and its Forestry Committee has made a most excellent report. This committee has had the benefit of advice and assistance from the various State Foresters in New England.

The report approves the present State fire laws, but urges more adequate appropriations for their execution. It also recommends laws to provide for the disposal of slash on logging areas and along rail and wagon roads in States where such laws are now lacking, together with measures for the lopping of tops after lumbering.

Of special interest is the suggestion that all lumbering operations be placed under license, and that cutting permits be required from the State Foresters, such permits to contain suitable regulations for the prevention of forest devastation, and the owners to receive certain emoluments and benefits (chiefly through a change in the system of forest taxation, pointing toward a yield tax).

The report is somewhat weakened by its approval of the Granville Bill which, at that time, was before the Maine legislature (this bill failed of passage). The Granville Bill provided for the creation of auxiliary State forests through the voluntary action of private forest owners, offering certain inducements to that end. Such legislation is wrong in principle and has been proved wholly ineffective in actual practice. Lumbermen have not stopped devastating their lands vol-

untarily in the past, nor is there any good reason to believe that they will do so in the future. Inducements, emoluments, and bonuses have had no appreciable effect anywhere in bettering forest conditions, although many of the States have tried them out. The cutting regulations provided for in the bill are so meager as to be of little or no value.

It seems unfortunate, therefore, that the committee should have approved this bill, a weak measure not at all in harmony with the essential recommendations of the committee's report. Moreover, being concerned with a problem which to the particular interests involved appeared to be a local problem, it was also quite natural, perhaps, that the question of national control was not touched upon. This question might have been considered to excellent advantage. F. E. O.

LOUISIANA'S SEVERANCE TAX

The forest stands in the forefront among Louisiana's natural resources. It has been for years one of her chief sources of wealth. The products obtained therefrom have already reached the peak of production and are now on the decline both in volume and quality. Recently Governor John M. Parker has proposed a severance tax on timber when cut which is likely to be enacted into law. This will impose a tax of two per cent on the stumpage value of all timber at the time of cutting. With the forests of Louisiana decreasing both in area and quality it is proposed to levy an annual severance tax of approximately fifty thousand dollars on the remainder. But for what purpose? One's first thought naturally is to secure funds for reforestation and the perpetuation of her forest industry. Not at all. *Her object in levying this tax is to secure funds for the general expenses of State.*

The writer believes that a severance tax on timber when cut is a sound and legitimate tax and might well be collected in every State. However, when this tax is collected *to help pay the general expenses of State it is a cold blooded deliberate assault on the goose that lays the golden egg.* The only justification for a severance tax on timber is to secure funds to perpetuate the forest industry. When so used it is desirable from every point of view. If the State of Louisiana would use the funds derived from this tax in the furtherance of her forest industry there is no reason why she should not become in a comparatively few years one of the leading States in forest conservation. To-day she is exhausting one of her greatest natural resources. A wise use of the severance tax can perpetuate this resource through forest renewal. She is to-day without State forests. Were these funds used for the purchase of wisely selected State forests two decades hence they would be ample in area to place her in a most admirable position as to forest ownership. Let us have a severance tax but let us use the funds derived therefrom for the sole purpose of forest conservation.

J. W. T.

NOTES

REPORT OF COMMITTEE ON CO-ORDINATION OF FOREST PRODUCTS RESEARCH AND NATIONAL FOREST ADMINISTRATION

The following recommendations for closer co-ordination of the work of the Forest Products Laboratory and the districts were made to the Madison Section Society of American Foresters:

Close co-ordination of the work of the National Forests and the Forest Products Laboratory is believed essential to the most effective progress on the part of the Forest Service in its own forest administration and in the broad field of forest utilization. The character of co-ordination and co-operation needed can be accomplished, in the judgment of your committee, only through the medium of personal contact by which a clear understanding of the problems and resources of the two branches can be established and maintained. The absence of any definite policy in this respect by the Service as a whole has tended more toward a drifting apart of the two lines of work than toward a natural and desirable drawing together and common appreciation of efforts and purposes.

The medium of letters, reports and other routine documents has, in the mind of your committee, wholly failed to establish proper contact and mutual appreciation of common interests and common aims. It has in fact, in a number of instances, had the opposite effect because of misunderstandings and inability to reach a common point of view. This medium will be of real value, it is believed, only when a much closer personal contact has been established and the branches are intimately familiar with one another's problems and conditions. The fact should not be lost sight of that research in forest products and research in silviculture are interdependent and together form the ground work for the most intelligent, effective, and foresighted administration of our national forests but that without proper stimulation of interest between the two lines of work, the essential tie will be lacking.

Your committee, therefore, recommends that a definite service policy be established and put into effect as rapidly as possible which will make provisions along the following lines:

1. More frequent visits to the Forest Products Laboratory by the district foresters and the assistant district foresters in charge of silviculture. These visits should be of sufficient duration and frequency to enable the foresters to obtain a thorough grasp of the work of the laboratory, its broad application to forest administration, and the requirements and possibilities of co-ordination and direction within the districts.

2. More frequent trips to the districts by representatives of the laboratory for the purpose of gaining a more intimate knowledge of conditions in the various districts, of discussing on the ground related problems and means, and of considering the lines along which the work of the laboratory and the districts can best be co-ordinated and directed in order to meet effectively the needs and aims of forest administration.

3. A definite program of details whereby:

(a) Men engaged in products work in the districts will be detailed to the laboratory each winter if possible for a period of weeks.

(b) Each man engaged in silvical research in the districts will be detailed to the laboratory at least once.

4. Attendance at supervisors' and district foresters' meetings of a laboratory representative in order that the laboratory may keep in touch with the broad administration and technical problems of the districts and may present the resources of the laboratory in the light of those problems.

5. The appointment by the Forester of a committee of five members consisting of the assistant forester in charge of research who shall be chairman, two members from the district organization, and two members from the laboratory; this committee to meet annually to plan and co-ordinate a definite program of co-operative or related work.

Your committee further believes that it would be highly desirable and beneficial to effect an exchange of details between the laboratory and the districts whereby a limited number of supervisors or timber-sale specialists from Forests or regions, where utilization is intense or becoming so, could spend some time at the laboratory and laboratory men could spend some time on the Forests, thus bringing about mutual education and co-operation in meeting or preparing for special situations.

O. M. BUTLER, *Chairman.*

In the JOURNAL for November, 1919, is a paragraph (which I overlooked at first) over the initials "E. N. M.," stating that there are California trees which have contained more sawable timber than the full volume of the giant Kauri tree "Kairaru" 31,416 cubic feet, or 376,992 board feet. The comparative size of the giant Kauri trees of New Zealand and of the largest specimens of *Sequoia gigantea*, is more fully discussed in my recently issued report "New Zealand Forestry," Part 1, Department of Forestry, New Zealand, 1919. From this it will be seen that it is not claimed that the largest of the giant Kauri trees had dimensions equal to those of the largest of the California "big-tree," but that, owing to the cylindrical stem of the giant Kauri trees, they probably contained a greater volume of sawable timber. The writer of your paragraph states that a *Sequoia* tree "cut in 1854 called the 'Mother of the Forest'" had a diameter of 30 feet and a height of 321 feet and *contained 537,000 board feet*. He does not state how this high volume figure was obtained or what was the taper of the tree. The other instances quoted by E. N. M. are measurements of height and diameter only.

I take it that E. N. M.'s tree, "Mother of the Forest," is not the same as that mentioned in Bulletin No. 397, "Calaveras Big Tree National Forest," for that had a gross volume of only 140,619 board feet and it was the largest tree in the Calaveras Grove in 1912. In stating the maximum authentic dimensions for the California "big-tree," I have quoted the best American authorities, Sargent, Sudworth, and others, and the two official bulletins, No. 95 "Commercial Woods of the U. S. A." and No. 397 "Calaveras Big Tree National Forest."

The figure quoted by E. N. M. is so much beyond that given by the recognized authorities, that one naturally questions its authenticity. It was not every one who could measure trees accurately in 1854. Much later than that date there were trees of *Eucalyptus* regions over 500 feet in height! Writing in 1885 von Mueller, the well-known Australian botanist, says categorically, "Mr. G. W. Robinson, surveyor, measured a tree at the foot of Mount Baw Baw which was 411 feet high!"

Needless to say these ancient stories of gigantic trees are no longer credited.

D. E. HUTCHINS.

Wellington, New Zealand.

In introducing Dr. B. E. Fernow for an LL.D. degree, President Falconer of the University of Toronto, said: "Those who have known

this University for the past thirteen years have recognized Dr. Fernow as one of its distinguished figures. Both in the United States and in Canada he was the pathfinder and still remains the outstanding authority as to the theory and the practice of the forester's profession. His knowledge of the subject is unrivalled, his labor is spreading its principles by pen and speech has been unceasing, and his success as an organizer unqualified. A well educated gentleman of refined tastes and perfect self-control, Dr. Fernow has won the admiration of his students and his colleagues, and he has our deep sympathy in the impairment of his health, which has been partly caused by his unremitting activity over a long life in extending a profession to which he has most unselfishly devoted himself. This degree will be but a slight expression of the gratitude of the University for his services as first Dean of the Faculty of Forestry."

UTILIZATION OF THE FORESTS OF ALASKA

Colonel W. B. Greeley, the Chief Forester of the United States, has returned from a month's inspection of the timber, water power and national resources of Alaska. In an interview in the *Seattle Post-Intelligencer* he is reported to have said:

Alaska has more than 100,000,000 cords of pulp wood. The territory has sufficient timber resources to produce 1,500,000 tons of paper annually. The Alaska Pulp and Paper Company, comprising California interests, is now constructing the first pulp plant at Port Snettisham, in southeastern Alaska. This mill will be supplied with 100,000,000 feet of timber just purchased from the Forest Service and is probably the forerunner of a large pulp and newspaper factory at that point.

In addition to the vast pulp resources of Alaska, Puget Sound offers splendid opportunity for at least six large pulp and paper mills. There are frequent inquiries of the Federal Forest Department for pulp wood concessions in this State. Even at the present time there is enough or would be enough wood of inferior quality cut in logging camps to support a large local paper industry here.

Establishment of such an industry on Puget Sound would be a great accomplishment from the standpoint of practical conservation—it would afford a market for inferior woods now being wasted in logging camps already established. In addition, there are large areas

of hemlock and spruce and balsam on the Olympic Peninsula and in the Snoqualmie National Forest. The entire forestry industry of the United States is moving westward, and with it is coming the paper industry.

Alaska contains 100,000,000 cords of pulpwood. She has the resources to produce 1,500,000 tons of paper yearly. That is nearly a third of the paper used in the United States, an amount nearly equal to what we are now compelled to import from Canada. With reasonable care, under the methods followed by the Forest Service, this output can be kept up from the National Forests of Alaska perpetually. There is a real solution of the paper shortage.

A few years ago we heard much about the inferior character of the forests in Alaska. As a matter of fact, aside from enormous quantities of good pulpwood and serviceable construction timber, the territory probably contains the largest quantity of clear, high-grade spruce to be found in the United States.

During the war this spruce passed every test for airplane construction, and it is now being shipped to the eastern States in increasing quantities for car and factory stock and high-grade finish. One of the things we shall accomplish by bringing the paper industry into Alaska will be to open up her thousands of miles of coastal forests and make available a much larger supply of special products like cedar, clear spruce and long piling.

FORESTRY EDUCATION

The British Empire Forestry Conference, which met in London during July adopted the following resolutions on forestry education, which the delegates are to bring to the notice of their respective governments:

It should be a primary duty of forest authorities throughout the empire to establish systematic schemes of forest education. It has been found, for climatic and other reasons, that it would not be possible for each part of the empire to establish a complete scheme of forestry education of its own, and therefore it is essential that those parts of the empire which are willing and able to establish complete systems should, as far as possible, frame such schemes with a view to combining for meeting the needs of those parts which can only themselves make a partial provision for their requirements. Part of this subject has been dealt with by a committee, whose report, which refers mainly to

the higher training of forest officers, is approved by the conference. The main principles embodied in this report are as follows:

1. That one institution for training forest officers be established in the United Kingdom.

2. That students be selected from graduates having taken honors in pure or natural science at any recognized university.

3. That it be an integral part of the work of the institution to arrange supplementary courses at suitable centers for students requiring special qualifications and also special courses for forest officers from any part of the empire, whether at the institution or at centers of training in other parts of the world. The governments should recognize these courses as part of the ordinary duties of the forest officers, at any time during their service, and the governments concerned should give special facilities to forest officers in their service to attend such courses.

4. That a department of research into the formation, tending, and protection of forests be associated with the training institution.

5. That encouragement should be given to the existing provision made by universities and colleges for forestry instruction for those who do not desire to take the full course suggested for the forestry service. It appears that this is especially applicable to the United Kingdom. It is also desirable to make adequate provision for woodmen's schools for the training of foresters as distinct from those which are intended for forest officers.

NORTH AMERICAN FOREST RESEARCH

The National Research Council reports that it has published a complete summary of all of the scientific investigations upon forest problems which are now under way in the United States and in Canada as a bulletin upon "North American Forest Research."

In this bulletin 519 different projects for investigation are described, including the reforestation of cut-over areas, the replacement of timber cuttings by natural growth, the control of insect pests and fungus diseases of forest trees, beneficial modifications of lumbering practice, the preservation of timber in use, the utilization of by-products, and the relation of forestry to rainfall, control of flood waters, grazing, etc.

A review of this bulletin will appear in the next issue of the JOURNAL.

The British Forestry Conference at the meeting held recently in London passed a resolution in favor of the formation of an Empire

Forestry Association, for the promotion and development of public interest in forestry throughout the empire, and also created an interim committee to consider ways and means. The committee appointed has drawn up proposals for circulation to all parts of the empire, for the establishment of a governing council for the association, and for the formation of an interim executive committee. The committee held that in view of the vast area embraced, the association's activities, apart from occasional conferences, must take a literary form. Its principal medium of communication would probably consist of a journal, issued quarterly. A publication of this kind, dealing with the needs, problems and progress of forestry in all parts of the empire, should, it is felt, be of interest and practical value to foresters, students of forestry and owners of woodlands, as well as the architects, engineers and traders interested in the distribution and use of timber.

Associate Professor Burt P. Kirkland, and Assistant Professor E. T. Clark, of the College of Forestry and Lumbering of the University of Washington, have been promoted, the former to a full professorship and the latter to an associate professorship.

Prof. James W. Toumey, director of the Yale Forest School, was honored with the degree of Doctor of Science at the commencement of the New York State College of Forestry at Syracuse.

Dr. C. C. Adams, director of the Roosevelt Wild Life Forest Experiment Station at the College of Forestry, was given the same degree at the Illinois Wesleyan University.

Forestry Training in the Heart of the Rockies

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SOCIETY AFFAIRS

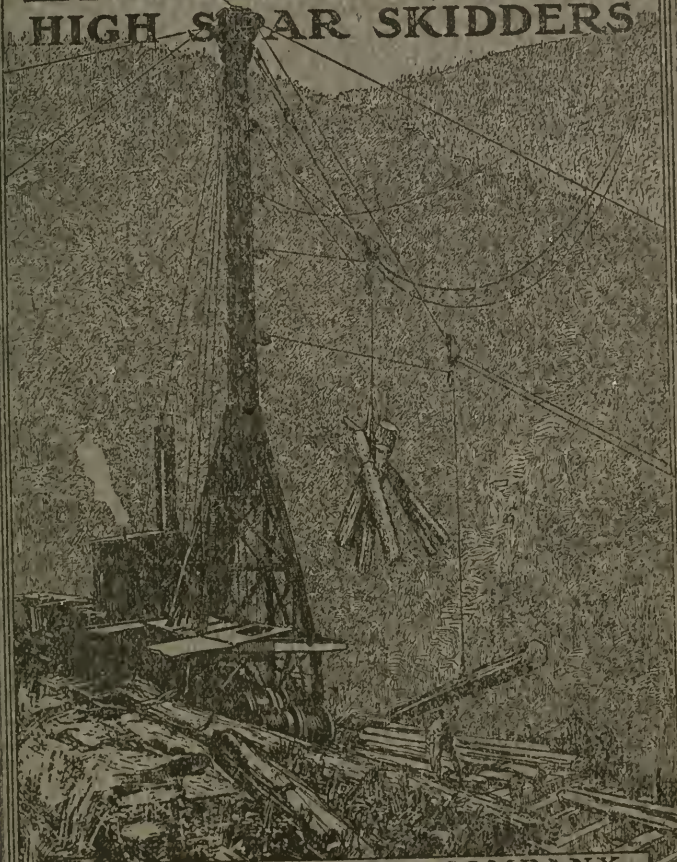
A REMINDER

There has been some criticism in the past that the Nominating Committee has too much power in determining the outcome of the election of officers of the Society. It may therefore be worth while to remind the members that Section 3, Article 5, of the Constitution of the Society provides, in addition to any nominations by the Nominating Committee, also for the nomination of officers by any ten Senior Members or Fellows. These nominations must be presented to the Secretary in writing at least four weeks before the annual meeting.

The New England Section of the Society held its first summer meeting at Keene, N. H., on Friday and Saturday, July 23d and 24th. There were twenty-five present. At the Cheshire House on Friday evening there was an informal discussion of the Report of the Committee on Forest Devastation and the "Pinchot" ballot. It was the opinion of a majority of the Section, as expressed in resolutions, that the individual States should be given the dominance in fixing and enforcing a system of forest regulation, and that the "Pinchot" ballot, so-called, did not permit a true expression of opinion on the advisability of State or national control.

On Saturday morning the Section met at the Lodge on the Yale Forest. At the meeting Mr. Hawley, for the Committee on Research, gave a very illuminating report on the present research activities being carried out in the New England States. The report showed that there is more intensive work being done along silvicultural lines than most of us realized. What is sadly lacking is an extensive survey of the forest resources of the region. A discussion on the forest tree supply for the region brought out the fact that there is need of more co-operation between collectors and State foresters and others who are consumers to stabilize the business. Prospects are good in New England for a large crop of white pine and white spruce seed this year.

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JOURNAL OF FORESTRY

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AMERICAN FORESTERS

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THE BRITISH EMPIRE FORESTRY CONFERENCE, 1920

BY CLYDE LEAVITT

Chief Forester, Commission of Conservation, Ottawa, Canada

The holding of the Imperial Forestry Conference at London, England, July 7 to 23, 1920, marks a distinct milestone in the advance of the forestry movement throughout the British Empire. The thoroughly representative character of the gathering, as well as the wide extent of the Empire itself, are exemplified in the list of delegates to the conference, which included representatives from the United Kingdom, England and Wales, Scotland, Ireland, Australia, Canada, India, Newfoundland, New Zealand, South Africa, Egypt and the Sudan, and the Crown Colonies of Ceylon, Cyprus, East African Protectorate, Federated Malay States, Nigeria, Nyassaland, Sierra Leone, Tanganyika Territory, Trinidad, Uganda and the Gold Coast. There were 35 delegates and 54 associate delegates.

The conference elected as its chairman Major-General Lord Lovat, K. T., K. C. M. G., D. S. O., Chairman of the Forestry Commission of the United Kingdom.

After visits to the Empire Timber Exhibition and to the Royal Botanic Gardens at Kew, the opening session of the conference was held in the historic old Guildhall, with addresses by the Lord Mayor of London, Lord Milner, and Lord Lovat. Later in the day summaries were presented verbally of the printed reports prepared for the conference on behalf of the respective units which comprise the Empire. Later sessions were held in the lecture hall of the Surveyors' Institution.

The topics which formed the basis for discussion were: Responsibility of the State for Forest Policy, the Forest Authority, Methods

and Problems of Technical Forestry, Education and Research, Empire Forest Resources and Consumption, Scope for Imperial Development, the Organization of an Imperial Forestry Bureau, and the Formation of an Imperial Forestry Association.

The discussions were thoroughly businesslike and resulted in the preparation of excellent committee reports, these in turn leading to the adoption of a comprehensive series of resolutions. The more essential points of these reports and resolutions may be summarized as follows:

1. *Forest Policy*.—Need for each of the Governments of the Empire to lay down a definite forest policy, to be administered by a properly constituted and adequate forest service.

2. *Survey of Resources*.—The foundation of a stable forest policy for the Empire and for its component parts must be the collection, co-ordination and dissemination of facts as to the existing state of the forests and the current and prospective demands on them. Tabular forms are presented, with a view to securing uniformity of presentation of such statistics as forest area, ownership, stand, increment, consumption, imports, exports, etc. It may be remarked, parenthetically, that most of the reports presented at the conference were conspicuous by the lack of adequate information as to forest areas, stands and increment, particularly the latter.

3. *Constitution and Status*.—To attain continuity in the development of forest resources, certain elements are essential in the constitution of the forest policy. These are: Definition of forest policy in a forestry act or ordinance; reservation of forest land; assurance of adequate funds for a series of years; civil service status to members of the forest service, with due provision for pension; high standard of personnel (selection and promotion by merit alone); the establishment in each of the larger parts of the Empire and for the Colonies not possessing responsible government collectively, of an officer or officers, having special duties of advising as to forest policy and surveying its execution.

4. *Organization of Forest Industries*.—The forest authority should be in close touch and consultation with organizations representing the interests concerned in the extraction and utilization of timber and other forest products.

5. *Publicity*.—It is the duty of the forest authority in every part of the Empire to adopt and encourage methods of education and publicity in order that the people may be fully informed of the aims and pur-

poses of forest policy and may thus be induced to co-operate toward its successful fulfillment.

6. *Distribution of Forest Plants.*—The conference has had brought to its attention the advantages which have accrued in several parts of the Empire from the wide distribution of forest plants, and desires to bring the method of encouraging tree planting by distribution of plants either from Government or private nurseries gratuitously or at cost price to the earnest attention of their Governments.

7. *Terminology and Trade Nomenclature.*—The following questions should be referred to the proposed Imperial Forestry Bureau immediately on its formation:

(1) Standardization of forest terminology.

(2) Correct identification of timbers, and standardization of their trade names.

8. *Research.*—Importance of systematic research in developing the growing and utilization of timber and other forest products. Primary responsibility of the State for forestry research work. Such work on an adequate scale can be efficiently conducted only by men who are qualified by training and taste for research and who are not hampered by routine or administrative duties. The salaries and status of research officers should be such as to attract and retain the services of the most highly qualified men. It may be of advantage for research officers to devote a limited portion of their time to educational work in their own subjects. Research will lose a great part of its value unless it can be followed by application to practice; a definite chain should thus be established between the laboratory, the experimental plot and the forest.

Accepting the principle of the primary responsibility of the State for forestry research, the further principle of State control and subsidy follows; the work may be carried out either directly by the State, through its own officers, or through the medium of universities, associations of individuals; this is a question of meeting local circumstances. In no part of the Empire is sufficient attention devoted to the investigation of silvicultural and statistical problems.

9. *Education.*—It is a primary duty of forest authorities throughout the Empire to establish systematic schemes of forestry education. For climatic and other reasons, it is not possible for each part of the Empire to establish a complete scheme of forestry education of its own, and therefore it is essential that those parts of the Empire which

are willing and able to establish complete systems should frame such schemes with a view to combining for meeting the needs of those parts which can only themselves make a partial provision for their requirements.

Much of the discussion and of the committee's report revolved about the most feasible method of meeting the requirements of the Indian Forest Service for the training of its probationers, though the needs of the United Kingdom also received much consideration. It is to the credit of the Government of India that after training probationers in various Continental schools, the first real steps were taken in England by instituting at Cooper's Hill College in 1885 special courses of instruction for Indian forest probationers. Twenty years later, on the closure of the college, the Oxford University Forest School was established. Meanwhile other universities had set on foot somewhat similar institutions, and eventually, about 1909, the Indian forest probationers were divided among the universities of Oxford, Cambridge, and Edinburgh, and this is the method in force at the present time. While some excellent results have followed, it is generally recognized that the existing arrangement is not satisfactory. Since India will require about 40 per cent of the forestry officers likely to be trained in the near future, the importance of avoiding another false start in educational matters is fully recognized.

The conclusion is that there should be one institution for training forest officers, to be established in the United Kingdom, and unconnected with any universities. This, however, is possible only with the fullest support of India and the Colonies. The students at this institution should be selected from graduates who have taken honors in pure or natural science at any recognized university. It should be an integral part of the work of the institution to arrange supplementary courses at suitable centers for students requiring special qualifications and also special courses for forest officers from any part of the Empire, whether at the institution itself or at centers of training in other parts of the world. The Governments should recognize these courses as part of the ordinary duties of the forest officer, at any time during their service, and the Governments concerned should give special facilities to forest officers in their service to attend such courses.

The committee report recommends also that a Department of Research into the formation, tending and protection of forests be associated with the training institution; also that encouragement be given the existing provision made by universities and colleges for forestry

instruction for those who do not desire to take the full course suggested for the forestry service; this is especially applicable to the United Kingdom.

Adequate provision is also recommended for woodmen's schools for the training of foresters, as distinct from those which are intended for forest officers.

10. *Forestry Bureau*.—The conference recommended the formation of an Imperial Forestry Bureau, to be supported by contributions from the United Kingdom, British India, the self-governing Dominions, and the Crown Colonies and Protectorates. The objects of such a bureau were defined as follows:

(1) To collect, co-ordinate and disseminate information as to—

(a) Forest education, research, policy and administration; the constitution, organization and management of forests; and matters arising out of or incidental to the growing of timber and other forest products.

(b) The resources, utilization, consumption and requirements of timber and other forest products.

(2) To ascertain the scope of existing agencies with a view to avoiding unnecessary overlapping.

(3) To devise means whereby existing agencies can, if necessary, be assisted and improved in the accomplishment of their respective tasks.

(4) To supplement these agencies, if necessary, in order to obtain any information not now collected which may be required for the purposes of the bureau.

(5) To advise on the development of the forest resources of the Empire or of particular parts thereof, in order that such resources may be made available for the purposes of Imperial defence or of industry or of commerce.

11. *Future Conferences*.—The opinion was expressed that the holding of conferences of representatives of the Empire on forestry matters is of great service. It was recommended that the next conference be held in the year 1923, and that if the Dominion Government approves, it be convened in Canada.

Between sessions of the conference, tours were arranged for the delegates, as guests of the British Government, to representative Crown and private forests in England and Scotland. In England, this included the Crown forests of Dean, Highmeadow, and Tintern, as well as

Windsor forest. In Scotland, visits were paid to Edinburgh (Royal Botanic Gardens, arboretum, and Forestry School), Dunkeld (Murthly estate), Grantown-on-Spey (Seafeld estate), Beaully (Beaufort estate, owned by Lord Lovat), and Novar (Novar estate).

While some areas were observed which have been in forest from the earliest times (e.g., some areas of very old oak in the Forest of Dean, and areas of Scotch pine at Grantown-on-Spey), by far the greater portion were planted forest of various species, ages, and sizes, ranging from new plantations to good-sized saw timber. In the older forests, oak, Scotch pine, beech, birch, and larch are the principal species, with these species and also Norway spruce, Sitka spruce, Douglas fir, *Thuja plicata*, and others represented in the more recent plantations. Douglas fir and Sitka spruce under favorable conditions have done splendidly in England and southern Scotland and are being used to a rapidly increasing extent.

The report of the United Kingdom, presented at the conference, bears out the general assertion that democracies are notoriously backward with regard to forestry practice, at least until the pinch of necessity becomes sufficiently felt to stimulate the adoption of adequate measures looking to the re-establishment of a forest cover on lands chiefly valuable for that purpose.

While the British Isles were formerly heavily forested, clearing has progressed until it is estimated that today there is in all England, Scotland, and Ireland only 5,180 square miles of forest, or 4.3 per cent of the land area. In England the percentage of forest to the total land area is 5.1, in Scotland, 6.0, and in Ireland, 1.5.

Approximately 470 square miles of timber land was cut over during the war, this comprising a large proportion of the mature coniferous timber in Great Britain.

As a consequence of this depletion, the United Kingdom has had to rely to a very large extent for its timber supplies upon imports from other countries, being the greatest importer of timber in the world. The shortage of shipping during the war, however, demonstrated conclusively the extreme undesirability of having to rely so completely upon foreign supplies.

As a result of careful consideration by the British Government, measures are now under way which will in the course of time, restore the United Kingdom to a more self-respecting position with regard to forestry. Under the Forestry Act of 1919, a Forestry Commission

has been appointed for the United Kingdom, and an appropriation has been granted of 3,500,000 pounds sterling for its operations for a period of ten years. This is equivalent to around \$1,701,000 per year, at the normal rate of exchange. This money is to be used primarily for the purchase or leasing of land for afforestation, though other aspects of forestry work will receive attention. Large forest nurseries have been established, land is being acquired, and the program is already well under way. This extensive planting program by the British Government will, of course, be largely supplemented by extensive planting on estates and other private holdings. Many of the larger estates have their own forest nurseries, and in addition large commercial nurseries are in existence.

The British Isles were originally heavily forested. The long series of wars, however, extending over centuries, resulted in the devastation of enormous areas, supplemented later by clearing for agriculture, for revenue, and for other reasons. In Scotland, for example, great areas of forest were burned by the Romans in their invasion during the third century. The process was continued during the warfare between the Highlands and the Lowlands. Military reasons operated toward further destruction of the forest during the time of Cromwell. During later periods, great areas of forest were cut for purposes of colonization or revenue. Reforestation has been carried on for the most part by estate owners, in many cases for purposes of amenity or sport. Now, however, it seems probable that during the next ten years 75,000 acres will be planted in Scotland by the State; that 25,000 acres may be afforested through loans or other schemes in co-operation with local authorities and private owners, and that a similar area may be restored to trees in the woodlands exploited during the war, or a total of 125,000 acres for Scotland in the ensuing ten-year period.

Taking the United Kingdom as a whole, it is stated that the rate of felling, greatly stimulated by the war, is still far above the pre-war rate, and is at least double the current annual increment. Further, many of the large estates are being broken up, and the new owners may not, in many cases, take as much interest in the tending and replacement of the forest as did the former owners. On the other hand, there are some compensating factors which will tend to reduce the rate of cutting. It is clear, however, that even though a vigorous policy of afforestation be followed, some 40 or 50 years at least must elapse before the country in respect of its supply of home-grown timber can be in as good a position as that which it occupied in 1914. With continued support of the work of the Forestry Commission, as is to be anticipated, now that the Government has recognized the necessity, the situation will right itself in time.

Space does not permit specific reference to the highly interesting and valuable reports submitted by other portions of the Empire, of which that for India is worthy of special mention.

THE NORTHERN PACIFIC RAILWAY OR THE NATION— WHICH?

BY HENRY S. GRAVES

A total of about 3,800,000 acres of land in the National Forests of Montana, Idaho, and Washington, embracing some of the most valuable timber lands of the Northwest, worth \$50,000,000, or thereabouts, is at stake in a suit which was heard by the United States Supreme Court early in October. Upon the outcome of this case depends the retention of these lands by the Government or their passing into the hands of the Northern Pacific Railway Company. It is not too early for the Forest Service to consider how it can best handle and protect the National Forests which would be affected if the contention of this company is sustained in its claim to this land which for the past 15 or 20 years or more has been reserved and administered for National Forest purposes.

This railway company was given a land grant in 1864 of all non-mineral, unoccupied, odd-numbered sections within 40 miles of each side of the road. By the same Act it was given the privilege of selecting under certain conditions odd-numbered, non-mineral, unoccupied sections within an additional 10-mile strip on each side of the 80-mile grant. By Congressional resolution dated May 31, 1870, it was given the additional privilege of making similar selections within a second 10-mile strip on each side of the road, extending the checker-board system of railroad lands over a strip 120 miles in width across the present States of Montana, Idaho, and Washington. About 40 years after this grant was made to the Northern Pacific Railway Company, the Government, by Presidential proclamation issued under Congressional authority, created numerous National Forests in the timbered regions of Western Montana, Northern Idaho, and the Cascades of Washington. Such parts of these Forests as lie within 40 miles of the railroad line are therefore checkerboarded, the Government's ownership being confined to unoccupied even sections and to such odd sections as were found to be barren mountain tops or dreary burned wastes; the rocky, barren sections having been classi-

fied as "mineral," a classification which naturally proved exceedingly beneficial to the railroad, since it enabled the company to select valuable "non-mineral" lands in lieu thereof within the two 10-mile indemnity strips. The rumors of frauds in the interest of the railway company connected with this classification, however, are another story.

The point is that every odd-numbered section in the National Forests of Montana, Idaho, and Washington, lying within 40 miles of the main line of the Northern Pacific Railroad was acquired by the railway company if it was considered worth owning. If it was not considered worth owning, it is National Forest land. The two 10-mile strips on each side of the 80-mile strip crosses and includes parts of the Custer, Beartooth, Shoshone, Absaroka, Gallatin, Madison, Beaverhead, Clearwater, Bitterroot, St. Joe, Coeur d'Alene, Wenaha, Jefferson, Helena, Lewis and Clark, Flathead, Blackfeet, Kootenai, Kaniksu, Wenatchee, and Snoqualmie National Forests. Most of these Forests were created during the first years of the twentieth century, although parts of the Forests surrounding the Yellowstone National Park, and parts of the Bitterroot and Clearwater were created earlier.

During the past 20 years the Government has expended large amounts of money in protecting these lands from the ravages of fire and in the construction of roads and trails, and other improvements designed to bring about the highest use of these great national properties. This was done in the face of violent local opposition which demanded that the lands be left open to the provisions of the homestead law, which would allow the acquisition of valuable timberlands by squatters without actual agricultural value resulting.

While those fights against selfish local interests have been won we now face the even greater menace of these national assets being added to a vast estate which already approaches monopolistic proportions in our richest timbered regions. It is exasperating and almost heart-breaking now to learn that the Northern Pacific Railway Company instead of the people of the United States may be the real beneficiary of this part of the fight for the conservation of our great Forests.

On October 4, 1920, the case of the United States of America vs. the Northern Pacific Railway Company (No. 325) was argued before the Supreme Court of the United States. Upon its face this case only involved the title to 5,681.76 acres of land situated in the Gallatin National Forest in Montana. In effect, however, it places on trial the right of the Government to retain ownership to the odd sections

falling within the indemnity strips so described. In round numbers, therefore, it actually involves the Government's title to approximately 3,800,000 acres of National Forest land, some of it being the most valuable timber lands of the Northwest. The railway company appreciates the importance of this opportunity to enrich the value of its holdings. Its officers have frequently referred to the suit as involving an issue worth thirty million dollars. The estimate is no doubt conservative.

This situation indicates the tremendous handicap which has been placed upon the Forest Service in its endeavor to protect the public interest in our national timberlands. If the railway company had been willing to assume the responsibilities of ownership it could have secured these lands before their withdrawal for National Forest purposes by depositing with the General Land Office the estimated cost of their survey and examination, and by filing its selection lists upon acceptance of the survey. But this was not done. Obviously, actual ownership and possession carries with it responsibilities and obligations as well as benefits. If the railway company had selected these lands in this way it would have been forced to pay taxes upon them and to bear the burden and expense of their protection and administration. The failure of the railway company to initiate the selection of these lands by application for survey indicates that they were not at that time considered worth owning.

If they had not been included in the National Forest the valuable timberlands would have been taken up by squatters in advance of survey during the past few years, and the railway company would never have secured title. If they had not been included within the National Forest much of the timber would have been burned and destroyed, so that the present value of the lands would be of little consequence. But since they have been under Forest withdrawal and administration, title has not passed to individuals and the timber has been protected. This, together with the depletion of our forests elsewhere and the need of the public for lumber, makes these lands now exceedingly valuable. Therefore, the railway company now desires to secure them. Hence the suit now at issue.

If the contention of the railway company is sustained, the plan of management for each of the 21 National Forests named must necessarily be completely revised. No doubt it will be found that many improved ranger stations are located on odd sections which would be

acquired by the railway company. The Government can not safely wait until the railway company actually attempts to select such sections, but in the event of an adverse decision must move promptly with a view to saving as much from the wreck as possible by transferring the improvements to even sections wherever this is physically possible. No doubt many of the sawmill sites essential for the utilization of the forest crop on different watersheds would be found to be on odd sections, and therefore control of the entire watershed would be largely governed by the demands of the railway company. As to telephone lines, roads, and trails, the Government is in a less hazardous position. The railway company has realized that such improvements were advantageous to its own holdings, and has uniformly followed the very generous and liberal policy of allowing the Forest Service to construct telephone lines, roads, and trails, across its lands anywhere within the National Forests, without let or hindrance. Undoubtedly the same policy would be pursued if, as the result of the suit now pending, the scope of the railway company's jurisdiction should be extended over the odd-numbered sections within the indemnity limits.

Reasonable forethought requires also that the Forest Service make an immediate review of its timber-sale situation within the indemnity strips, with a view to adjusting such timber-sale contracts as may be affected by an adverse decision. A great many sales have already been made within these strips and the timber cut and removed. Many sales are also current. It would be necessary to prepare to take whatever action the situation requires if the decision is adverse and the railway company immediately selects the odd sections involved in any large going sale. In such cases a contract with the Government would be involved. The operator will have made plans and investments based upon the assurance of being able to secure the timber from the total contract area. As an innocent third party, he should be protected, and the Forest Service should endeavor to secure from the railway company in such an instance the recognition of the rights of the purchaser, so that the operator might continue as before, excepting that his payments for the timber cut from the odd sections would go to the railway company instead of to the Government. An interesting question is also involved as to the right of the railway company to demand from the Government payment for timber which the Government may have sold and which has already been cut and removed from such odd

sections. If it is finally held that the Government has not reserved such odd sections from selection by the railway company, it is difficult to see how it will be possible to justify the Government's retaining the fruits of the disposal of the major values from such sections. This involves still further complications by reason of the fact that 25 per cent of the receipts from the disposal of such timber have been paid to the States for roads and schools. In case of a refund by the Government what means should be adopted to secure from the State its contributory share? These problems, distasteful though they are, must frankly be faced by the Forest Service in order that an adverse decision may not find it unprepared to handle the situation as well as the law and its limited authority will permit. It must be recognized that the forest supervisors would be forced immediately to make innumerable adjustments of the grazing privileges enjoyed by stockmen because of the changed status of such odd sections which have been used under Forest Service permits for the past 15 or 20 years. Special use permits involving heavy investments by innocent third parties must be given consideration and measures taken to soften the blow of an adverse ruling.

Such work as is done now must be largely in the nature of an emergency preparation and cannot be expected to contribute in any great degree toward the final solution of the railroad land problem within the National Forests. It is obvious that these great National Forests cannot continue to exist and be protected and efficiently managed while including a checkerboard arrangement of odd sections over which the Government has no control, upon which there is no adequate system of fire protection, and for which there exists no plan of silvicultural management. Eventually each of these large units must either come under the complete control of the Government by exchange or purchase or be relinquished by sale or gift to the complete control and exploitation of private interests. This is the railroad land problem which loomed large even before the menace of the present dangerous assault upon the Government's acreage. If the contention of the railway company should be sustained the difficulties of this problem will be at least doubled. Even without taking into account how such a decision might affect the other railroad grants crossing the National Forests, the problem is one of sufficient seriousness to demand the most earnest united efforts in preparing to meet it.

FORESTRY AT NEHASANE PARK

BY RALPH C. HAWLEY

Nehasane Park comprises about 36,000 acres (of which over 3,000 are in lakes and ponds), located astride the Adirondack branch of the New York Central R. R., approximately 75 miles north of Utica, N. Y., and within the region known as the Adirondack Mountains. Since 1912 the writer has made annual trips of two weeks' duration with classes of students to this region, camping either on the property (through the courtesy of the owners and of F. A. Gaylord, Superintendent and Forester), or a few miles distant.

The forestry work is of especial interest to the profession, because of the fact that H. S. Graves was responsible for the first cuttings made about 20 years ago and because these cuttings were the first to be made on a large scale embodying the forestry idea. The writer has often been questioned with reference to the results of these old cuttings, and as to the character of the work now in progress. This has led to the belief that it may be of interest to set forth the impressions gained from a series of annual visits.

The property is owned by the Webb family and was acquired and is held primarily for use as a hunting and fishing preserve and as a summer home.

When Graves started the cutting of the timber the forest (which is typical of the region), was a virgin growth of beech, yellow birch, hard and soft maple, hemlock, red spruce, balsam and a few less important species.

Judging from the stumps of the trees cut, the present stand and the character of the timber on uncut lands adjoining, the trees reached the following maximum ages: Hemlock 500 years, red spruce 400 years, hardwood 250 to 300 years, balsam 150 years. While trees of many ages were present, those of the older age-classes predominated and occupied an unduly large proportion of the area.

The cutting advised by Graves¹ was confined virtually to red spruce and the scattered white pine. The beech, birch, maple, hemlock, and balsam were scarcely considered merchantable at that time. Graves advised a selection cutting of spruce down to an approximate diameter

of 10 inches at breast high. Under this plan the entire property, with the exception of belts along lakes, streams, or other areas reserved for aesthetic reasons, was cut over between 1896 and 1904. This cut returned a profit and reduced the investment.

It was a light cutting, and at once or within a period of about 20 years, the crowns of the remaining large tolerant trees occupied most of the small openings. Measurements taken in this region indicate that on a single acre the spreading and overlapping crowns of the hardwoods alone have a crown spread equivalent to more than an acre and a half of space. Only around skidways or where patches of timber were removed was there much interruption of the canopy. Increased growth following the cutting is relatively small.

While failing to stimulate growth, to increase the percentage of softwood, or to replace an over-mature, decaying forest by a healthy young forest, Graves' cutting was the best possible, considering the market conditions of that time and the sentiment in favor of very conservative cutting on private preserves.

From 1904 to 1915 no cutting was done. In 1914 a resident forester, F. A. Gaylord, was employed and plans for a second cut initiated.

The forest at the time of this second cutting was still essentially virgin, lacking only the larger, older, and better quality spruce originally present. The hardwoods, hemlock and balsam, were badly infected with wood-rotting fungi, while the character of the spruce was distinctly of "second cut" rather than "old growth" size and quality. Possibilities for selling forest products had greatly improved and the sentiment, in reference to cutting timber, of owners holding private preserves had undergone a distinct change.

With such differences, between the present and 20 years ago, in the yield per acre of the spruce, in the economic factors governing forestry practice, and in the viewpoint of the average owner an entirely different style of cutting from that started by Graves logically was demanded. It is now evident that the selection method, which Groves used probably because he could not use any other, is entirely unsuited to the present form and condition of the virgin or lightly culled forest of the western Adirondacks. The markets now take hemlock and balsam for pulp as well as the spruce. There is a demand for hardwood logs of beech, birch, and maple. All species are saleable today.

Since the first cutting and before Gaylord took charge of Nehasane Park, a disastrous fire ran over approximately 13,000 acres of the

property, destroying the existing growth. This reduced the timberland area available for a second cut to about 20,000 acres. During the last six years, including the operations contemplated for 1920, about 12,500 acres have been cut over a second time for softwoods and a large proportion of this area has also been logged for hardwoods. There remains roughly 7,500 acres which at the present rate of cutting will be logged for softwoods within five years. The hardwood logging may require a few additional years.

Gaylord makes a heavy cutting which removes the greater part of the spruce, hemlock, and balsam. These species are cut in the spring and summer when the bark peels easily. In the late summer and fall the hardwoods are cut.

Neither the trees to be cut or those to be left are marked, the cutting being controlled by inspection, and trees below certain diameter breast high limits being reserved. For spruce the diameter limit is 8 inches, for hemlock and balsam 6 inches, for hardwoods 16 inches. Softwoods are merchantable above 4 inches breast high and hardwoods above 12 inches. Softwood tops are lopped as required by the State law. Hardwood tops are left as they fall. The yield secured averages, for all types combined, 8 cords of pulpwood per acre and 1,000 feet board measure of hardwood logs with hemlock bark in addition.

In discussing the condition of the forest after this cutting it is sufficient to recognize two types:

(a) Softwood land, which includes swamps and low-lying areas where the hardwoods are either lacking, or few in number, and not able to compete successfully in reproduction and growth with spruce and balsam. Occasional steep, rocky slopes, ledges and knolls clothed with softwood are found, but they are of relatively small area and may be disregarded.

(b) Hardwood land, where hardwoods form the predominating element in the forest, particularly in reproductive ability. This class of land comprises ridges where hardwoods are nearly or quite pure and also stands of mixed hardwoods and conifers.

The following two tables show the number and sizes of trees left on a few sample areas of each of these two classes of land, and indicate the condition of the softwoods, whether with free or overtopped crowns, and the condition of the hardwoods as to soundness. It is evident that in the balsam swamp type (softwood land), the hardwoods are an unimportant factor, while on hardwood land the reverse

is true. The large cull hardwoods, while not numerous are, due to their large crown spread, of predominating importance.

TABLE 1.—*Number of trees per acre left in the balsam swamp type (softwood land) after the second cutting.*

[Based on three one-quarter acre plots, except the figures for reproduction which were secured on three one hundred and sixtieth acre plots.]

D. B. H., inches	Spruce		Balsam		Birch		Maple	
	Free	Over- topped	Free	Over- topped	Good	Cull	Good	Cull
	Number of trees per acre							
Repro- duction...	2,240				427		800	
2	9.32	5.33	2.66	4.00	.....	.....	.....	.....
4	12.	5.33	8.	2.66	.....	.....	1.33	.....
6	9.33	2.66	13.33	.....	.....	.....	1.33	1.33
8	13.33	.....	5.33	1.33	1.33	.....	1.33	.....
10	2.66	.....	.....	.....	1.33	.....	.....	.....
Total ^a	46.64	13.32	29.32	7.99	2.66	.....	3.99	1.33
	Grand total 105.25							

^a Totals do not include the amount of reproduction.

Note the excess of softwood over hardwood reproduction and that the hardwoods (exclusive of reproduction) form only about $7\frac{1}{2}$ per cent of the stand. Most of the overtopped softwood is under softwood rather than hardwood.

On hardwood land 36 per cent of the trees (exclusive of reproduction) are softwoods, but these are principally small trees. Only 42 per cent of the softwood is free from suppression.

The suppressed trees are nearly all standing under hardwoods. Numerically only 27 per cent of the hardwoods are cull trees, but this hardly explains the real situation. All the large remaining hardwoods are culls and most of the small hardwood is overtopped. Less than 15 per cent of the reproduction on hardwood land is softwood. Chandler² has made a more detailed study of the composition of the forest and comes to similar conclusions.

In appearance the softwood lands look well, but the recently cutover hardwood lands look badly, due to the large number of defective trees left standing and to the large unutilized tops of the felled hardwoods.

The percentage of softwood on the hardwood lands evidently has decreased.

TABLE 2.—*Number of trees per acre left in the hardwood type after the second cutting.*

[Based on 49 one-quarter acre plots, except the figures for reproduction which were secured on 49 one hundred and sixtieth acre plots.]

D.B.H. inches	Beech		Birch		Maple		Spruce		Balsam		Hemlock	
	Good	Cull	Good	Cull	Good	Cull	Free	Over- topped	Free	Over- topped	Free	Over- topped
Number of trees per acre												
Repro- duction	2,363		1,146		3,364		924		261			
2	4.65	1.63	1.71	1.14	1.06	.08	4.97	9.06	.40	.32	.....	.16
4	6.93	2.61	3.51	1.14	.98	.40	5.79	6.53	.49	.24	.....	.08
6	3.83	2.28	3.51	.89	1.71	.08	4.40	3.67	.57	.16	.32	.24
8	4.40	1.30	2.36	.73	1.63	.57	2.93	1.30	.24	.08	.08	.24
10	2.93	1.14	1.79	.40	2.04	.08	.65	.32	.....	.....	.08	.....
12	4.08	.97	1.79	.08	1.71	.16	.....	.....	.....	.....	.....	.....
14	2.85	.49	1.06	.16	.81	.81	.....	.....	.....	.....	.....	.....
16	.65	.89	.57	.08	.16	.08	.....	.....	.....	.....	.....	.....
18	.....	.73	.....	.16	.....	.24	.....	.....	.....	.....	.....	.....
20	.....	.24	.....	.56	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.24	.....	.16	.....	.....	.....	.....	.....	.....
26	.....	.....	.....	.40	.....	.....	.....	.....	.....	.....	.....	.....
28	.....	.16	.....	.08	.....	.....	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	.08	.....	.....	.....	.....	.....	.....	.....	.....
Total ^a	30.32	12.44	16.30	6.14	10.10	2.64	18.74	20.88	1.70	.80	.48	.72

^a Totals do not include the amount of reproduction.

The aesthetic requirements have been met as in the first cutting by reserving belts of uncut timber beside lakes, streams, roads and on a few conspicuous hills.

TECHNICAL CRITICISMS OF THE FORESTRY PRACTICED AT NEHASANE PARK

The simplest way of discussing the character and soundness of the forestry work on the park is to take up in turn each of the various criticisms which have been brought to the writer's attention by professional foresters. It has been assumed that the object of the owner is still as stated by Graves:³ "to cut as much timber as possible without injuring the productive power of the forest." If the owner were interested only in logging the present stand and did not desire to practice forestry criticism of the management from the forestry standpoint would be pointless.

Criticism No. 1.—The forest has not been put upon an annual sustained yield basis.

In reply it may be said that forestry does not require such action on an individual tract. Provided the area is kept productive the yield may be on either an annual or a periodic basis. There is one controlling factor which makes periodic preferable to annual sustained yield at the present cutting. This is the overmature condition of the growing stock. Defective trees, both softwood and hardwood, or sound trees approaching the maximum age for the species occupy the greater part of the crown canopy. Decay more than offsets growth in these trees; and the uncut forest as a whole may be considered at a standstill so far as growth is concerned. Graves⁴ recognized this but his first cutting did not succeed in materially changing the situation in the forest because only the old spruce was removed. Spruce was the least decrepit species and occupied only a small part of the forest canopy. The second cut cannot be made too soon if increase in the annual production of the forest is wanted.

Additional reasons for completing the second cut within a few years are:

(a) The decrease in taxes after the land is cut over.

(b) The necessity, in order to pay for required logging improvements, of logging larger areas in a year than the size of the tract, divided into logging units on the basis of an annual cut, would allow.

Criticism No. 2.—The second cutting has been too heavy.

This is a debatable point and admits of considerable latitude of judgment. The writer inclines to the view that the cutting is none too heavy and that if any change were to be made, it should be toward heavier rather than lighter cutting.⁵

In the balsam swamps after the lightest cutting (and even in the uncut timber) the larger softwood trees blow over or are broken off. To prevent loss from wind and fungi a diameter limit as low as six inches is justified. Balsam is so short-lived and subject to butt-rot that, in consideration of its growing principally on swampy ground where trees are easily windthrown, clear cutting or use of a low cutting limit is imperative.⁶

The limit for hemlock is correctly placed low because the tree is an inferior species which it is not desirable to favor.

On the hardwood lands large decaying hardwoods remain, which prevent the productive utilization of the area under their crowns. (See Table 2.) A much heavier cutting of hardwoods which would include the cull trees would improve the productive power of the forest.⁷ The possibility of accomplishing this will be discussed under point No. 6.

It is an open question whether in the case of beech and maple a lower cutting limit, namely, the lowest possible from the economic standpoint, should not be used, in order to favor yellow birch and spruce and to prevent loss which now occurs among the maple and beech after cutting, through the dying of medium sized trees left exposed.

It is possible that a higher limit might be used to silvicultural advantage with spruce on hardwood land. The objections are, that:

- (a) The cut per acre already is low under the present limit, and
- (b) Most of the spruce over 8 inches diameter are mature.

The average age of spruce 8 inches in diameter was found to exceed 150 years.

Criticism No. 3.—The diameter limits are too rigidly applied.

This is not true for hemlock because it is an undesirable species.

In the case of spruce, balsam and hardwoods there is something to be said on both sides.

The rigid application of a diameter limit is recognized quite generally as unsound in principle. Its use in controlling cuttings on private lands is favored because it is the easiest and cheapest method for the forester to enforce and use of any other method required a more capable personnel. The alternative methods are careful control of cutting by frequent inspection, or, better than this, marking⁸ all trees to be cut.

The advantages of employing a diameter limit elastically rather than rigidly are too well understood to require discussion here. Instances have been observed on the park both where trees above the limit could have been left and those below could have been cut to advantage. The operation of leaving above and cutting below the limit is susceptible of being so handled as to make little difference one way or the other in the total amount of timber removed from a given area.

While in theory a rigid diameter limit is unsound, yet in practice there may be found types, divisions within types, or individual tracts

where results fully as good as those secured by marking can be obtained by applying rigidly a diameter limit. The logging contracts on the Nehasane Park provide for the reservation of trees above the limit and for cutting those below, if designated by the forester. As a result of study by the forester in charge of the park, it is his judgment that not enough is to be gained silviculturally through marking to pay for the extra cost.

Criticism No. 4.—The cutting is not distinguishable from that of a logging operation where forestry receives no consideration.

The best reply to this criticism is to call attention to the fact that a forestry cutting may be identical in character with an ordinary logging operation. Similarity to the latter is not in itself a proof that the former is technically unsound. The time has passed, if it ever existed, when it is necessary for foresters to conduct work in an uneconomic manner merely to achieve something different from an ordinary logging job. In fact, it is advisable to depart as little from customary procedure as will suffice to accomplish the purpose of forestry.

Cutover areas can be found in the Adirondacks either better or worse looking than the lands at Nehasane; but in this region the appearance of a given area after logging depends more on the species cut, the amount of defective timber in the stand, and upon the possibility of utilizing hardwoods than on the question of whether or not forestry is being practiced by the owner.

Criticism No. 5.—The forest is not being managed so as to increase the percentage of spruce.

This is true; but it is considered unsound forestry practice to attempt such a step. On the softwood lands the percentage of softwoods is maintained or increased, but on the hardwood land the percentage is decreased.

No one species should be favored over the whole area. The paramount consideration is the replacement of over-mature, defective timber with a healthy young crop. The composition of this crop is distinctly secondary.

The only way in which the percentage of spruce could be appreciably increased in the future forest would be by heavy cuttings followed by artificial regeneration^{2 7 9} and by cleanings. This is too intensive a

method for present conditions especially in view of the uncertainty of the financial outcome.

Spruce may give a heavier yield of timber to the acre than a hardwood stand; but who can predict the relative prices of the different species in the future?

Criticism No. 6.—When the second cutting is finished the forest will still contain many cull hardwoods whose crowns occupy a large proportion of the space and render the area so covered unproductive.

This condition occurs only on the hardwood lands. It is evident from a casual inspection of the forest, that the situation is as described. Evidently the second cutting has failed to remove entirely the over-mature timber and change the forest into one which is mainly composed of young, healthy and rapid growing trees. How to free the forest of the cull hardwoods is the most pressing problem of management. The hardwoods readily saleable have already been removed in the second cutting.

The forester has tried the experiment of putting the cull hardwoods into cordwood. Although this was done during the war when the demand for cordwood was better than the average, still the operation was a loss financially. Utilization for cordwood appears impracticable because of the long shipment to market, unless younger and sounder trees are included in the cut. Such action would require nearly a clear cut and would destroy the growing stock of young hardwood which is more valuable for the third cut.

Many of the cull trees contain some good material and it would seem that a way of utilizing the sound portions might be developed. Perhaps it could be found in a wood-working plant of small capacity to run in connection with the property for the special purpose of working up the cull hardwoods and the tops of good hardwoods now left to waste in the woods.

Such a plant requires skilled labor and a permanent community. Skilled labor is exceedingly difficult to keep under the conditions of isolation prevailing at Nehasane Park. Furthermore a permanent community of laborers is exactly what is not wanted on a park of this character. It is a good example of the influence which the purpose of the owner exerts in determining the character of the work possible on any tract.

The forester studied the question of utilizing the cull hardwoods during the first two years of his incumbency and came to the conclusion that they cannot be utilized in a way advantageous to the best interests of the Nehasane Park Association.

If utilization of the poor trees proves impossible, a cheap method of killing them would seem the only way of eliminating their monopoly of the area. As yet this has not been tried. In consideration of the ultimate benefit to accrue from placing seedlings and young trees in a free position, a reasonable expenditure per acre appears amply justified and indeed vital to the health of the succeeding forest.

The cost of girdling and its effect upon the forest has not been determined. The cull trees may exert a favorable effect for a few years following the second cutting as a shelter to assist the establishment and early development of reproduction, which on a heavily cleared, unshaded area with few seed trees remaining might be kept out for years by berry vines or brush. Another argument against starting the girdling right after the cutting is that, in certain places (both on areas uncut and cut for the second time), the hardwoods, particularly beech, have been dying in considerable numbers for the last few years. It may be possible to save a part of the expense of girdling by waiting for a period of 5 to 10 years and allowing nature to assist.

The aesthetic effect of girdling for a few years until the dead trees fall to the ground will not be pleasing.

No forest pathologist, so far as is known, has ever studied the conditions in the Adirondacks for the purpose of determining the necessary measures to be taken, if young crops of timber are to be protected from early and serious infection from older fungi-attacked trees. An investigation of this kind is necessary before methods of killing or removing the cull hardwoods can be applied effectively. Such protection of the young crop is imperative if the future production of the forest is to be brought to a high point.

Criticism No. 7.—A large share of the Park (about 40 per cent of the land area) is heavily burned land, and nothing has been done to make it productive.

Portions of the burn are already stocked with a dense growth of young hardwood, which needs no attention. The writer has seen only a limited part of the burn. It is evident that certain areas need

complete restocking. Yet the record of plots taken systematically on a section of the burn 2 miles by three-quarters of a mile indicated a good stand on the average of young hardwood.

How much of the burn actually needs reforestation has not been determined accurately. The forester has already planted approximately 400 acres and intends to continue the work. In 1920 175 acres were planted.

TABLE 3.—*Number of trees per acre on the burn.*

[Based on 45 one hundred and sixtieth acre plots. The trees were mainly less than 10 feet in height but a few larger individuals were found.]

Height in feet	Spruce	Aspen	Beech	Birch	Maple	Total
Number of Trees per Acre						
0 to 0.5	.....	.....	17.6	11.2	602.8	631.6
0.6 to 1.0	17.6	17.6	30.8	49.6	209.6	325.2
1.1 to 5.0	75.2	17.6	732.8	720.0	408.0	1,953.6
6.0 to 10.	30.8	.....	796.8	764.8	110.4	1,702.8
D. B. H., inches						
1	.....	20.8	124.8	224.0	17.6	387.2
2	.....	3.2	60.8	70.4	43.2	177.6
3	3.2	.....	3.2	60.8	.....	67.2
4	.....	.....	.....	3.2	31.2	6.4
5	.....	.....	3.2	.....	.....	3.2
7	.....	.....	3.2	.....	.....	3.2
10	3.2	.....	3.2	.....	.....	6.4
11	.....	.....	3.2	.....	.....	3.2
12	3.2	.....	3.2	.....	6.4	6.4
13	.....	.....	.....	.....	.....	6.4
14	3.2	.....	.....	.....	.....	3.2
Total.....	136.4	59.2	1,782.8	1,904.0	1,401.2	5,283.6

In conclusion, the writer, notwithstanding the points found to criticize, feels that the forester at present in charge of Nehasane Park has in his management of the property performed a creditable piece of professional work. He has failed as yet to solve the perplexing problem, more important than all other details, of securing the establishment of a thrifty young forest unhampered by heavy-foliaged defective hardwoods. The ultimate success of the forestry work on the park is likely to be estimated by the profession in accordance with the accomplishments made within the next few years in solving this problem.

During the present administration the telephone and road system has been improved greatly, and fire protection thereby strengthened.

In 1914 the park had only four telephones on 18 miles of wire, giving poor service, and 18 miles of road, only five of which were passable for autos. Today 18 phones on 26 miles of wire connect logging camps, watchmen's cabins and sporting camps with headquarters in an efficient system, giving continuous service. There are 24 miles of road, 20 of which are in good shape for motors. A 70-foot steel lookout tower with a watchman on duty the entire fire season, connected by two phone lines to headquarters, overlooks practically all the property.

The owners of the park are to be congratulated upon sanctioning the utilization of the over-mature timber. Owners of private preserves, whether of large or small size, may well take a lesson from Nehasane Park in this respect. Timber on private preserves has too frequently been allowed to rot and the land to remain unproductive. Owners capable of investing in and holding tracts of wooded land are exactly the type of owners who should be growing timber crops.

What has been said in regard to the methods of cutting and to the silvicultural operations on Nehasane Park should not be construed as necessarily applicable to the Adirondack forest region as a whole, since it must be recognized that differences in the object of owners and in the character of the land and timber may require different methods of treatment.

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IS AMERICAN CHESTNUT DEVELOPING IMMUNITY TO THE BLIGHT?

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The American chestnut (*Castanea dentata* [Marsh.] Borkh.) is a forest tree of first importance in the hardwood forests of eastern United States. Therefore, when, about fifteen years ago, it was realized that a fungus of unparalleled destructiveness had begun to eliminate this species, and that an epidemic was upon us which promised to spread over the entire chestnut range with incredible swiftness, the economic and practical phases immediately became urgent. The destruction progressing in plain sight on such a scale attracted and interested many people who perhaps had never before given plant diseases a second thought. It was investigated from many angles by technical men, as foresters and plant pathologists, by public men, economists, those directly interested as lumbermen, wood-using industries, timber owners, etc. In a few years the literature on the subject was considerable, consisting of articles on all phases, published in newspapers, trade journals, technical periodicals, and in governmental and institutional reports. There were conferences held and much discussion as to methods of eradicating the disease, checking its spread, and salvaging the damaged merchantable material. One State (Pennsylvania) appointed a special commission and provided a substantial appropriation for the solution of these problems. In other places local quarantines were established. All of which shows that the general public became aroused rather early to the necessity for action.

In this connection a few points may be given on the origin and spread of the disease and some of the later conclusions in regard to it. Chestnut blight, or chestnut bark disease (*Endothia parasitica* [Murr.] And.), apparently introduced from the Orient, was noticed first in 1904 in Bronx Park, New York, where it had probably been present for ten years at least. In two years it was already locally epidemic and by 1910 had swept across most of New Jersey and southeastern Pennsylvania with a 75 per cent destruction. Since

then it has extended west and south and at present (1920) has covered destructively northern Virginia, with many advance local infections farther south. From the rate of advance, pathologists have concluded that the entire range of chestnut will be covered by the blight in the next twenty-five years. It is estimated that it takes ten years in a given locality to reach a complete infection and ten years more to kill all the trees—two decades thus elapsing between the beginning of the infection and complete destruction of the chestnut stands. The disease does not spread at so rapid a rate as was at first thought, but measured in decades it still is rapid. It appears that the disease cannot be eradicated nor stopped from spreading although it may be checked by cutting out and by quarantines, and delayed by natural barriers. The time must come, therefore, when all the merchantable chestnut will have been completely killed throughout the entire range. The principal means of spreading is the wind, although other agencies are important. Long range infection is probably caused by birds, and then the wind, together with all other agencies, is responsible for the spread of the local spot infections.

IMPORTANCE OF CHESTNUT

Chestnut is distributed over a wide range in eastern United States, occurring in seventeen States in commercial quantities. It is estimated that there is 19 billion^a feet board measure of chestnut saw timber in the United States, over two-thirds of which is south of the Mason and Dixon line. Considering the wide range of uses and high stumpage it is easily seen that tremendous values are involved here. In some places chestnut forms over 50 per cent of the total forest stand. It has large use for poles of all kinds, posts and mine props, as well as railroad ties and lumber, on account of its strength and durability. In the South it is the main reliance for raw material for the tannin extract industry. The great sprouting capacity makes chestnut admirably suitable for coppice management, one of the simpler silvicultural systems of forestry. It is thus of great service in the early stages of forestry in the country in that through it may be introduced the general practice of caring for forest resources systematically under modern plans. All these phases of its usefulness are threatened as the blight, in its destructive stages, closes in on the remaining uninfected chestnut areas in the South.

^a See Table 7, p. 34, Report on Senate Resolution 311 ("Capper Resolution"), June 1, 1920.

RESISTANT TREES

The hopelessness of controlling the blight by any of the ordinary methods naturally turned investigators' attention to a search for resistant strains. Apparently there is some encouragement in this direction, for early in 1908 Metcalf¹ pointed out that some strains at least of the Japanese chestnut are immune. Van Fleet² reports from twenty years' experience in breeding chestnut that: "The Asiatic chestnuts, and the chinquapin-Asiatic hybrids, are plainly highly resistant. Few have shown any appearance of infection and when noticeable *the injury is quite local in character. Second generation seedlings* of chinquapin-crenata crosses show no disease at all though always exposed to infection." Morris³ (1914) reports that five trees of *C. mollissima* have not been affected, although American trees have died all around them. Specimens of *C. alnifolia* also have remained free from the disease. In concluding on this point Anderson and Rankin⁴ state: "In brief, it may be said that there is no species of *Castanea* which is wholly immune. Some varieties show marked resistance, and Metcalf (1914) claims apparent immunity for certain strains." The earlier work along this line seems to have dealt largely with resistant foreign strains for orchard purposes. Later more attention was given to forest conditions of the native chestnut. In 1918 A. H. Graves⁵ "investigated conditions in the American chestnut looking toward immunity or disease resistance." He reports carrying on a thorough search in the earliest infected regions (immediate vicinity of New York City) and states that he found no immune trees but did find a considerable number of resistant trees. He cites as evidence of resistance the following:

1. Reduction of average lateral growth of fungus in inoculation tests.
2. The occurrence of the trees in a neighborhood long subject to the disease.
3. Healed cankers, thrifty branches with bases diseased and hypertrophied but living, etc.
4. Peculiarities of the bark; such as extensive development of a *callus* tissue, and the presence of a peculiar substance.
5. The natural grouping of the trees in well-defined areas or "pockets," pointing to a genetic variation.

6. Similar degrees of resistance shown by members of the same coppice group (and by branches of the same tree) indicating an inherent condition.

Graves then concludes that by working with this native resistant material and by crossing with resistant oriental species, an extremely resistant or practically immune strain of chestnut timber may be developed to replace the blight ravaged areas. A recent article by Collins⁶ supports the resistance conclusion and gives examples of recovery.

No attempt has been made in the foregoing to cover all the work which has been done on blight resistance but merely enough to show clearly that there is resistance and that it has attracted the attention of investigators. The contribution which the writer of the present article desires to make follows:

DEVELOPING IMMUNITY

It seems very clear from the facts now available, viewing the whole chestnut range and considering but a brief period of time, that the blight will sweep over the chestnut areas as a wave and leave nothing but dead trees in the present stand. A few trees left by accident will succumb to later attacks. Then will follow a period of sprouting and killing back of the successive sprouts. Will all these sprouts on all the trees be killed eventually by the blight? On the answer to this question may hinge the future of American chestnut as a forest type or as an element of practical importance in the forest. It should be kept clearly in view that the coppice group, and not the individual trees or sprouts in it, is the unit. Therefore until the entire group is no longer able to send up sprouts that particular unit is not dead. The first attacks kill all the large trees and merchantable material, and successive repeated attacks have kept and are keeping the sprouts from reaching merchantable size. Consequently, for all practical purposes at present the blight has wrought a complete destruction of the chestnut stands wherever it has approached complete infection. The dead trees continue to sprout at the base and below the point of infection while the smaller stems sprout repeatedly after being killed back by the blight. This increases the length of life of the vegetative unit (the coppice) two or three decades, perhaps, and offers an opportunity for changes to take place between the host plant and the parasite.

Briefly stated the hope for the future of chestnut as a forest proposition lies, the writer believes, in the possibility *that the species is now actually developing immunity in its struggle with the parasite*. The young sprouts are the battle ground, and the older infected areas are one vast natural laboratory in which is being worked out, before our eyes, the problem of the survival of chestnut. What facts and indications support such a hypothesis?

The Significance of Hypertrophy

In looking over the diseased trees on the ground and in studying the charts in publications there appear definitely two distinct types of canker. One is shrunken in appearance and shows a very marked depressed surface on the bark (*atrophy*), the other is characterized by a swollen distorted appearance (*hypertrophy*). What does this mean? Can one not read from these two distinct indications a decisive difference in the reaction of the respective hosts to the parasite? In the first it would seem no resistance is met, while in the second a struggle is going on—a decided resistance to the invader is made. (For an illustration of these two types of canker see Plate 37 of Bulletin 347,⁴ Cornell Agricultural Experiment Station, and Plate 1, Bulletin 380, U. S. Department of Agriculture. The latter is interesting as the figure showing the sunken canker indicates developing resistance as the disease progresses—note the hypertrophy at the edges).

The hypertrophied cankers are not an infrequent occurrence. A number of observers have noted them. Graves,⁵ as already stated, gives them as evidence of resistance. Collins⁶ has reported this form also, and the writer (1920) noted a number of hypertrophy cankers in eastern Pennsylvania and northern New Jersey.

Another point is, that these cankers (the hypertrophy type) are invariably found on young, vigorous or rapidly growing sprouts or branches—just the place where one would expect a struggle to occur. Rankin^b states: "On young rapidly growing coppice, however, swollen areas (hypertrophy cankers) with the bark split open lengthwise are commonly found." Anderson and Rankin⁴ (at page 549) say: "Cankers on rapidly growing limbs are usually outlined by a distinct ridge of slightly hypertrophied tissue." In the Pennsylvania chestnut tree blight commission's report for 1912 are shown two figures of

^b Manual of Tree Diseases, W. H. Rankin, at page 141, 1918.

hypertrophy with descriptions supporting this point—Fig. 28, “Blight canker on branch showing characteristic swelling and cracking of bark *on young wood*,” and Fig. 29, “The figure at the right shows a young infection *with an enlargement, which is often characteristic in vigorous branches*.” Heald^c says “Enlarged lesions are apparently the most frequent on vigorous shoots,” and note also, the figures: Figures 5 and 6 show “characteristic hypertrophy of two-year-old shoot”; Fig. 7 shows characteristic hypertrophy *of vigorous shoot*.” Other examples could, perhaps, be given, but the foregoing substantiate, if they do not prove, the important fact in connection with the present hypothesis—that hypertrophy, caused by a struggle between the host and parasite resulting (if the host is victor) in a higher degree of resistance, would naturally occur on the most vigorous parts of the plant, i.e., young, rapidly growing sprouts. The writer’s own observations the past field season in Pennsylvania and New Jersey are in accord with the foregoing.

Opportunity for Immunity

To develop immunity requires time to accumulate resistance and take advantage of it. Usually the organism succumbs to the invader before it can increase resistance sufficient to overcome the parasite. The chestnut trees are killed, but the sprouts continue the life of the individual unit (i.e., the coppice group) for a time. This period gives a chance to accumulate resistance in the same individual, and has, in fact, healed cankers. Other points may be attacked on the same stem later and may not be so successful, but the fact that some cankers are healed indicates that resistance is growing. It might be well here to distinguish two kinds of resistance—one inherent in the plant, which might be called static resistance, and the other, increasing or decreasing as the struggle goes forward, could be called dynamic resistance. It is the latter which the writer considers the more important as it holds out the greatest hope. The former doubtless exists and through it, by means of crossing foreign resistant strains, investigators expect to develop high resistance and perhaps immunity.

In order for immunity to develop, certain other requisites (besides time) are necessary. In the first place, the invader or parasite must encounter the life force of the organism attacked; it must attack living

^c The Symptoms of Chestnut Blight, etc., Pennsylvania Chestnut Tree Blight Commission, Bul. 5, at page 5.

tissue. To illustrate: Wood destroying fungi although, in case of a living tree, apparently attack a living organism, do not do so, for they work in the lifeless wood of the central portions and are, therefore, actually operating on inert or dead material. Obviously, immunity can not develop here as no struggle takes place. In the blight the living tissue is attacked (as the cambium and adjacent areas) and the life forces are brought into action. If the sprouting continues long enough to give time it would seem that all essential requisites are present for immunity to develop or evolve. It is no more unusual or unreasonable for this to happen than for parasitic fungi to become saprophytic or the reverse.

Recovery from Blight

It is important to note the reaction of the host to the blight when attacked at different points. Young sprouts are the best material to observe. In large trees the blight works downward from the point of attack beneath the bark and will eventually reach the base and kill the entire tree if it is not killed by a reinfection below the original point of attack. Now, many cases of healed cankers were observed by the writer when small young sprouts were attacked near the top. The blight was arrested in its downward movement and if the sprout was killed later it was through reinfection from below. For convenience the points of attack may be grouped as near (1) top of sprout, (2) midstem, and (3) basal. In young sprouts, as before stated, recovery was noted frequently in (1) occasionally in (2) and not at all in (3), although much hypertrophy was noted in basal attack. A recent article by Collins⁶ records an apparently complete recovery (7 years' duration) from a basal attack on a young sprout. It is interesting to note his general statement on, and classification of, resistance: "In general it may be stated that resistance has been more pronounced in the last few years (four or five) than in earlier years," and further: "(a) the disease is progressing more slowly, or (b) the host is more successfully resisting the disease, or (c) the more susceptible trees have all been killed, or (d) some other factors are influencing results." These observations certainly support the hypothesis *that immunity is being developed in American chestnut following a period of struggle.*

CONTROL OF RESULTS

It seems more than likely that the blight must run its course in a given locality and the chestnut develop immunity by natural processes

through a period of time, perhaps short but maybe long. At least present indications are that it will require one rotation, or 30 years, to render the trees practically immune after the disease has reached its climax. Perhaps this period can be speeded up by keeping the sprouts frequently cut back when small and thus having them longer in a vigorous growing condition and favoring the immunization process. But this might delay the process by decreasing the struggle. It is worth at least an experiment on small areas.

In order to show whether resistance is increasing sample plots could be laid out in the older infected areas and examined at stated intervals. Even repeated observation of a few young coppice groups under average forest conditions would give definite comparative data. It may take only a few years to get certain results but it may take several decades.

In conclusion the purpose of this article is suggestive and to encourage definite systematic observation on the basis of the hypothesis: *that chestnut is developing by natural processes immunity to the blight through struggle with it.* Further, that from present information, the present stand of chestnut throughout its entire range is doomed; that if chestnut survives it will be due to its sprouting capacity and to its increase in resistance to the disease after the climax of the epidemic has passed, with its complete destruction of merchantable material.

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SUGGESTIONS FOR RATING RISKS IN FOREST INSURANCE

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GENERAL PRINCIPLES

The fundamental principle of insurance is the distribution of losses, in accordance with the law of averages, so that the burden of loss does not fall heavily on the individual. In theory, for each individual risk there is paid in annually a sum which represents its probability of loss, plus its share of the cost of doing business, and in the case of commercial insurance, a small margin for profit. From these pooled payments are paid out sums to cover the actual losses of individuals and the expenses of the business. The probability of loss, then, determines the rate of premium for each insured risk.

To be satisfactory, rates for any kind of insurance must meet three essential qualifications. These are:

1. Adequacy: they must be high enough to cover all losses and legitimate expenses, and in case of commercial companies, a reasonable profit, but should not be any higher.

2. Fairness: it is obvious that extremely hazardous risks should pay a higher rate than safer ones. Risks should be so grouped and classified that each class is normally (except in case of conflagrations) self-sustaining.

3. Consistency: risks of equivalent hazard should have the same rate.

DEVELOPMENT OF RATING SYSTEMS

In the early history of commercial fire insurance, rates were based altogether on judgment, and were very crude and unsatisfactory. Only within about the last half century have there been attempts to classify and rate risks scientifically, that is, on the basis of actual chance of occurrence of fires and of probable loss from such fires. A thoroughly scientific rating has not yet been developed, because of inadequacy and inconsistency of the fire records, and above all, because there has until recently been no central organization to standardize records.

The systems which have been most generally used are based on the *analytic* method. Risks are classified into a few broad groups, for each of which a standard risk and a standard base rate are fixed, largely by judgment. The component elements of risk (construction, occupancy, exposure, protection) are subdivided into subfactors which affect the hazard. One widely used plan uses more than 3,000 of these factors. Then charges or credits are fixed, largely by judgment, for variations from each of the subfactors as specified for the standard risk. In rating a particular risk, its subfactors of hazard are analyzed and the proper charges are added to and credits subtracted from the base rate. Although both the base rate and the charges and credits are theoretically based on actual fire experience, in practice they are not, and cannot be, except in a general way. This method attempts to estimate the cost of the *specific* risk—that is, the rate for each risk is based on the chance of loss of that particular risk. This method is admittedly not scientific, but is considered to be fairly consistent.

It has for some time been realized that there can be no permanent and satisfactory solution of the rating problem except one based on actual experience—on fire statistics. In order to give the law of averages room for play, and also to avoid giving the conflagration risk undue weight, it is necessary that rates should be based on the combined experience of a large number of companies (preferably all), over a fairly long period and for the whole United States. The National Board of Fire Underwriters, through its Actuarial Bureau, established in 1914, has undertaken to collect and compile the experience of its member companies, and has published a plan for classifying and rating risks, which is intended to be the standard for measuring insurance costs in the United States. This, known as the Experience Grading and Rating Schedule, recognizes these principles—that rates must be based on experience; that no two risks are exactly alike, therefore the risks in each class must be graded according to their comparative qualities; and that experience demonstrates the cost not of *specific* risks, but of the *average* risk of each class.

OUTLINE OF STANDARD E. G. R. SYSTEM.

In this system classification and grading of risks are based on the following considerations:

All losses are due to one of three fundamental hazards: *occupancy*—the use of space for storage, carrying on trade or manufacture, living,

or other purposes; *internal exposure*—fire originating from other occupancies of the same building; *external exposure*—fire originating from outside occupancies. The ability to withstand fire depends upon construction, and hazard is also modified by the quality of *private protection* within and of *public protection* without.

CLASSIFICATION

Risks are classified according to the following scheme:

A. Occupancy.

1. All cities and towns are graded into ten classes, according to a scoring system which takes account of water supply, fire department, alarm system, streets, police, building laws, explosives and inflammables, electricity, natural and structural conditions.

2. Occupancies are grouped in some 430 different classes, according to kind, such as manufacture of fireworks, clothing store, dwelling, hotel. Each of these classes may or may not occur in all ten classes of towns.

3. Each occupancy class is divided into three sub-classes, according to whether the building is of fireproof, brick, or frame construction.

4. Each of these three sub-classes is divided into ten grades of quality as to building, as to contents, and as to both combined.

5. Each of these thirty grades of building is again subdivided into ten grades according to contents, and each of the thirty grades of contents into ten grades according to grade of building in which located.

B. Exposure.

Classification as to exposure (internal and external separately) is made in a similar way, except that instead of the 430 occupancy classes there are only three groups (contents, building, building and contents), each of which are subdivided into three sub-classes (fireproof, brick, and frame), and that these sub-classes are graded according to exposure instead of according to construction or condition.

This is, of course, a very complicated classification, but once worked out, it may be expected to stand for a long time. Experience will probably show that many of the occupancy classes have equal hazards and can be grouped so that the number of classes may be considerably reduced.

Rating.

Rates are determined as follows:

1. A basic composite rate for the United States is obtained by dividing the sum of the losses and expenses of all companies, plus 5 per cent for profit, by the total insurance in force. A 10-year period was tentatively adopted for this purpose.

2. Basic rates for individual States are obtained in a similar manner, except that conflagration losses are prorated over all States. This gives the average cost for all classes of risk in each State.

3. The United States rate for each class of occupancy is found by dividing the losses for the class over a 10-year period, by the total writings for the class, which gives the loss-cost, and adding to it a sum corresponding to the average rate of expenses to losses over one or more years, plus 5 per cent allowance for profit.

4. In a similar manner the United States rate for each class of external or internal exposure, or both, is determined, and added to the occupancy rate.

5. This sum is then modified for the particular State where the risk is located, by the ratio which that State's base rate bears to the United States base rate. For instance, if the State base rate was 0.9 of that for the country as a whole, the rate for a particular class of risk in that State would be 0.9 of the United States rate for the class.

Under this plan, each State bears the cost of insuring its own risks, except in case of conflagrations, which are spread over the whole United States. The reason for making a division according to States is that different States have different laws, differences in climate and physiography, differences in character of population and in public attitude toward fires. It would obviously be unjust for the people of a State with especially good fire laws, backed by a sound public attitude on the fire question, to have to pay the same rates as those of a State with laws and public sentiment which almost encourage fires. It is believed that one effect of this system will be that States with unduly high rates will take steps to reduce them, through better fire laws, better law enforcement and careful investigation of the causes of fires.

"The Experience Grading and Rating Schedule is based upon a theory of measurement of hazard by statistical results while the Analytic and Universal Mercantile systems were elaborate and carefully designed applications of the combined judgment theory. The former is inevitably superior to the latter two if capable of overcoming

certain technical difficulties. It maintains the principle of average and distribution—yet embodies the idea of statistical justification of rates.” “Dissatisfaction must co-exist with any rate making system which could not be justified by statistics. In the field of rating theory the important question is, Will the companies endeavor to continue past methods of measuring hazard or will they cooperate in the support of a new system intended to furnish the public with the proof of equitableness which it demands? Every indication is that the latter is one of the great imminent developments of fire insurance.”¹

FOREST FIRE INSURANCE

I have outlined the methods of classifying and rating risks in regular fire insurance at some length, because I believe there is no great difference in principle between fire insurance of buildings and of forests. Given a reasonable amount of protection, the hazard is no greater, and may be considerably less, in the case of forests, and it is certain that with proper classification and rating of forest risks such insurance will be found very practicable.

Forest fire insurance has been developing in a number of European countries for several decades, but has not made as much progress as it might have made because the classification of risks has been very crude, and the rates have been too high in comparison with the hazard, therefore unattractive to forest owners. These rates are fixed arbitrarily and always with a wide margin of safety, because of the lack of accurate and reliable statistics of fire losses. Such classifications as have been made are based on differences in forest type (conifers, deciduous, or mixed) and in age classes, and allowances are usually made for public and private protection, and for such special risks as railroads. Regional divisions, to allow for climatic differences, have been suggested for classifying French forests.

GENERAL PRINCIPLES GOVERNING FOREST FIRE HAZARD

In the United States, with its great extent and its diversity of climate and of types of forest, much more detailed classification will be necessary than in Western Europe. The tentative plan for classifying and rating risks which is outlined below is based on these considerations:

1. The damage done by forest fires depends upon the area burned over, the value per acre of the burned forest, and the proportion of that value which is destroyed by fire.

¹ Robert Riegel—Fire Insurance Rates: Problems of Cooperation, Classification, Regulation. *Quarterly Journal of Economics*, August, 1916.

2. The area burned over depends upon the number of fires that start and the average acreage per fire.

3. The number of fires that may start depends upon the presence or absence of causes of fire at the time when the forest is in condition to burn. This to some extent is modified by regional differences and by differences in character of the forest.

4. The average acreage per fire depends on differences in climate, in type of forest, in inflammability of forest as influenced by character and condition of the stand and ground cover, and in the effectiveness of suppression organization.

5. The proportion of the total value of forest burned over that will be destroyed by fire depends upon the climate, and upon the type, age, and condition of the forest. Thus, the proportion of loss per burned acre will be much less in an open, clean stand of mature longleaf pine than in a heavy stand of young white pine with a heavy litter of dry slash.

PROPOSED METHOD OF CLASSIFYING RISKS

Following these principles, forest risks may be classified as follows:

(a) Divide the United States into a number of regions, chiefly on the basis of climate and general forest conditions. There will probably be between 20 and 30 of these regions.

(b) Classify the principal types of forest in each region, grouping types together where they are substantially similar in inflammability and in situation. There may be from 5 to 10 types in each region, probably nearer 5 than 10 in most regions.

(c) Divide each type into about 4 age-groups, as, for instance, reproduction, poles, immature merchantable, mature. The points of division will of course vary somewhat with type and with region.

(d) Subdivide each age group into several (perhaps five) grades of comparative inflammability, using a scoring system that takes account of the character and condition of ground cover (duff, grass, weeds, brush, reproduction, debris from lumbering, windfalls), standing snags, moss and dead lower branches on trees, density of stand and of crown cover, scars or pitch streaks on trees, character of soil, slope, and exposure.

(e) Grade each of the above grades of inflammability into several (perhaps 5) classes according to the comparative possibilities of sup-

pression, scoring such points as detection, means of communication and transportation, location and character of regular protective force, location and adequacy of equipment and supplies, available help (quantity, quality, and time required to get it), fire lines or other provision for checking or helping to check fires, and available water.

(f) For occurrence of fires, classify the risks in each type in each region, as outlined in paragraphs (a) and (b), and subdivide them according to exposure to causes of fire. Risks more than one-half mile or one mile from any special hazard, or even closer if separated from it by a natural or artificial break which will stop fires, may be considered as subject only to the general hazard of fires from natural causes or scattered chance fires from human causes. Risks adjacent to or within a half mile or a mile of special hazards and not separated by effective fire breaks, will be classified as subject to such special hazards. These include railroads, logging operations, industrial plants, settlements, land-clearing operations, routes of travel, places frequented by campers and smokers. A given risk may be subject to any one or to all of these hazards. I have purposely omitted incendiarism because I doubt whether forests should be insured in regions where public sentiment stands for incendiary fires except as rare occurrences.

PROPOSED METHOD FOR RATING HAZARD

The loss costs of the different classes of risk can then be determined by the following method:¹

1. For each of the classes described in paragraphs (a) to (d) above, divide the total loss over a period (preferably at least 10 years) by the total value on the burned area previous to the fire. This will give the damage factor, which may perhaps be considered as the combustibility of the given class of risk.

2. For each of the sub-classes described in paragraphs (a) to (e), compute the average acreage per fire (excluding conflagration). This result will integrate the factors of rate of spread and of effectiveness of fire protection.

3. For each class of exposure hazard, outlined in paragraphs (a), (b), and (f), above, compute the average number of fires that occur from that cause per unit of area, say per 100,000 acres.

¹ I will not attempt at this time to discuss the question of allowances for operating expense or profit. These, if forest insurance were undertaken by a public agency, might not enter into the problem.

4. Compute the average total annual conflagration loss for the entire United States, per \$100 of value insured.

To rate a specific risk, classify it according to specifications given, and multiply the damage factor for that class by the area factor for the proper sub-class, then multiply this product by the occurrence factor for the kind of hazard involved. If the risk is subject to more than one form of hazard, add the occurrence factors for the different hazards in the given type and region, and multiply the damage-area product by this sum. The final product will give the rate of loss (excluding conflagration losses) for the specific risk involved. Since it is considered proper here as in regular fire insurance, to spread conflagration losses over the whole system, the conflagration rate for the country as a whole should be added to the normal rate as found.

An example will perhaps make this clearer. Suppose we take the least inflammable class of western yellow pine stands in eastern Oregon. Suppose the records show that on the areas burned over during the past ten years, 5 per cent of the total values present (timber and all other values) were destroyed. (The figures are purely imaginary.) The damage factor is then .05. Suppose that for the areas of this class which have made 3 protection systems, the average fire, excluding conflagrations, was 20 acres. Suppose the general blanket risk (lightning and other scattered fires) for yellow pine in this region to be 5 per 100,000 acres; the risk of railroad fires on areas subject to railroad hazard in the type and region, 50 per 100,000 acres, and the risk of camper fires on areas subject to this form of hazard, 45 per 100,000 acres. Suppose we take a given area of this class of timber, subject to all three forms of hazard. Then the occurrence factor will be 5 plus 50 plus 45, or 100 per 100,000 acres, or .001. The product of the three factors $.05 \times 20 \times .001 = .001$, or 10 cents per \$100 of value. If the conflagration rate for the country is found to be 3 cents per \$100, then the total loss-rate for the given risk will be 13 cents per \$100.

While this scheme appears somewhat complicated, it is much simpler than that outlined by the National Board of Fire Underwriters, and will be much easier to work out when we get the basic data. In forest insurance we are up against the same difficulty that was found in insurance of other property—namely, the want of a central bureau to standardize records of losses and of writings, and to collect and compile these records and develop from them a standard rating. Our

fire records are incomplete, inaccurate, and lacking in uniformity, and do not in most cases give the detail necessary for proper classification, while our knowledge of the values at stake is even more deficient. I believe, however, that if such a central actuarial bureau could be established to collect and compile fire statistics, and if all of the agencies concerned—Federal, State, and private protective organizations—would whole-heartedly cooperate with it, a tentative classification and rating could be worked out in a very few years that would form a safe and reasonable basis for forest insurance on a large scale over the entire United States.

FOREST CONDITIONS AND PRIMITIVE FOREST PRACTICE IN WEST PERSIA

BY EDWARD C. M. RICHARDS

By West Persia is meant that portion of the kingdom of Persia lying just south of the Caucasus, bounded on the west by Turkey, on the east by the Caspian Sea, and running about 200 miles directly south. This area of country is known as the Province of Azerbaijan, and is perhaps the most fertile part of all Persia.

All of the interior of Persia is composed of a high plateau with sharp declivities running down to the Caspian, the Persian Gulf, and the valley of the Araxes River, which separates West Persia from the Caucasus. West Persia is in itself more or less the top of the plateau, although there are some mountains and ranges of mountains which stand up above the general country. In general the elevation of the lower portion of the country is about 4,000 feet above the sea, while some of the highest mountains run up to 12,000 or 13,000, making the most beautiful scenery and holding snow for months after the rest of the country has been laid bare by the hot sun of spring. A little west of the center of the province lies the basin in which the great salt lake, Lake Urumia, extends some 90 miles north and south and 30 east and west. From the upper slopes of the mountains on all sides this big lake received a large flow of water each year, principally in the spring when each stream becomes a torrent. Back from the lake, and in other parts of the province also, the level ground is carefully irrigated—the most primitive methods being used—and where there is enough water the people can usually be very successful in cultivating their wheat, millet, and barley fields, their apricot, almond, walnut, and peach orchards, and their vineyards. There is little or no forest growth on the hills or mountains and only very rarely a scattered tree, the entire country being used for grazing wherever possible and where not used for agricultural crops, the pasturage of sheep, goats, water buffalo, cattle, and beasts of burden entering in no small way into the agriculture of the region.

The climate of West Persia is delightful. In winter the temperature rarely goes below 10° F. above zero, and although there is some-

times as much as a foot of snow, this is rare, a few inches being all that ordinarily is found on the ground at one time. In all the total precipitation of the whole year is about 15 inches, all of it falling between December 1 and June 1, approximately. This leaves the six summer months open to the rays of the sun, which at this altitude and latitude are very intense, more especially because only occasionally obscured by clouds. The altitude, however, keeps the air cool so that even on the hottest day the shade will be found to be cool and comfortable. At noon in summer it is unwise for an American to go out in the sun, even in a cork helmet. The natives close up shop and quit work, for the most part, between 11 and 3, making up for it by staying open later on in the evening.

Most of the mountains, the high ones particularly, are of evident volcanic origin, their rocks being clearly metamorphic. The foothills are markedly unlike the higher peaks, with sharp pointed summits, but are usually of very wounded form, without cliffs, for the most part, and generally composed of sandstone or in some cases limestone, and covered with wild bunch grass which makes grazing over them common. Coal measures—of very poor quality, unfortunately—are found in at least two parts of the province.

A variety of soils are found but on the whole it may be said that on the wide plains the soil is a very deep, heavy adobe, while on the hills the presence of more or less sand and rock renders the soil unsuited to anything but grazing or the growth of trees. It is noteworthy, however, that the heavy adobe soil has a tendency to dry out and cake up into very hard chunks, under the action of the sun, a fact of importance to anyone starting a forest nursery. The use of this adobe soil for building purposes is universal wherever it is found.

The life of the mass of the population centers about the water supply of the country, the long drought in the summer making irrigation necessary for most of the farming, although a little "dame" (unirrigated land) is made to produce a special variety of wheat. The importance of protective forest cover on the watersheds is therefore very great. Owing to entire lack of knowledge in regard to this matter, however, whatever once existed in the way of natural forest growth has long since been cut and burned up, as has been done in China. Before the Moslem conquest of Persia the national religion was Zoroastrianism or fire worship, and scattered over the plains about Lake Urumia are a number of large ash hills which sometimes attain

to a height of 200 or 300 feet and a circumference of a mile or more where, there is good reason to believe, the ancient Parsees kept the eternal fires of their sacred shrines burning. A comparatively meagre expenditure of effort in digging in these hills will bring to light ancient brass ornaments, pottery and other relics of this civilization of the past now covered up in the ashes of what probably were the former forests of West Persia.

The population of West Persia is made up of a mixture of races, religions, and sects, as follows:

1. The "Moslems," as they are called by the Europeans and Americans to separate them from the other peoples, are not pure Persian stock, but are mixed with Tartars and Turks. They are vastly in the majority in numbers.

2. The Kurds, of distinct race and Mahomedan creed, make up a smaller group, located in the mountains for the most part, are more of a pastoral people than the "Moslems" who tend toward farming.

3. The Armenians, who are better known and more prominent in business than as connected with agriculture.

4. The Syrians, or Assyrians as they call themselves, claiming direct descent from the ancient kingdom of Assyria of Old Testament fame, who are both farmers and business men.

5. In addition to the above-mentioned established races there is a floating population of scattered individuals brought in by the war and the unrest. Russians, Georgians, Turks, Tartars, and perhaps others make up this group.

The basic activity of the country is agriculture, the manufacturing being limited and of small account considering the mass of the inhabitants. Rugs, silk and wool and cotton cloth, native shoes of crude pattern, jewelry and ornaments, pottery, bricks and leather make up about all that might be classified as the products of manufacture. Everything is crudely done in a most primitive way. The wonder of the Persian rugs is appreciated when the background of the "factory" is seen. (The industrial revolution which came to Europe with the invention of the steam engine and machinery has yet to arrive in Persia with the first up-to-date machinery of any kind. The country is perhaps 500 years behind America in civilization.) Outside of the few large cities and towns little or nothing but agriculture is practiced. The country towns and villages lie scattered about over the fertile part of the country each surrounded by its own fields, orchards

and vineyards. No individual farm houses exist by themselves out in the country, as everyone hurried home to the shelter of the village when the darkness comes, it being often as much as one's life is worth to be out alone at night, and single, rural dwellings would be at the mercy of any band of robbers that happened along. At harvest time, however, parties of men usually stay at the threshing floors or guard the orchards or vineyards. Security of property or life is never very great, compared with America.

The ignorance of the people is profound. As an illustration, the idea of breeding animals to better the strain is practically unheard of. All sheep, goats, cattle, and poultry are scrub stock, although the sheep and goats are often comparatively good. The idea of spraying fruit trees or vineyards is unknown to all but a few who have seen some of the missionaries spray their trees. Caterpillars are allowed to destroy everything that they get on, or else, as in the case of rich men, they are hand-picked by men, boys and women at so much a caterpillar.

Along with this ignorance there is a crude sort of knowledge, the product of age-long experience. The reproduction of trees by coppice, and by cuttings, pollarding willows, grafting, budding, layering, and the planting of trees along irrigation ditches are common knowledge and practice. Along the line of close utilization, however, they excel—every twig, leaf and piece of bark being used for fuel if for nothing else.

Little or no land is owned by the poor man, the rich khan (gentleman) owning often a dozen villages or more and renting them out to the poor tenant farmers who are really little better than serfs. There is scarcely anything which directly contributes to the poverty and backwardness of the country as does this pernicious land system. Under it the rich khan who owns the land rents it out to the farmer at the annual rental of one-third of the gross crop at the end of the harvest. If the farmer supplies the seed he keeps two-thirds of the crop himself, but if he has to get the seed from someone else that man gets one-third. This land-rental system works great injustice, even under the best conditions, and often the khans will refuse to rent the land unless they are also allowed to supply the seed, thus taking two-thirds of the crop as their annual rent. The result of the system is that the farmers are kept poor and are usually only a month or less ahead of starvation, a crop failure meaning real famine at once. Meanwhile the rich man lives in idleness and dissipation. Under this system

few farmers own any large area of land. To help the farmers, therefore, is difficult, because what is done for him goes, in great part, into the pockets of the rich owners of the land.

As in all Moslem countries, deceit and theft are very common—much more so than here in America. People who are well off if they own half an acre of land, a buffalo, and a few chickens are more apt to be tempted to covetousness than an American can usually appreciate. Add to this the corruption of Mahometanism which winks at almost anything that we consider moral, and openly advocates much that we vigorously condemn, and it is easy to see that stealing and lawlessness would tend to become common features of the daily life of the people.

To sum up, then, West Persia is an agricultural country where much grazing is done, where security of property is precarious, where profound ignorance is modified only by very scant knowledge, where the land is largely owned by a few rich men who oppress the poor bitterly, the whole resulting in a universal lack of honesty and integrity among the people of all classes. Such is a brief summary of some of the more important influences bearing upon forestry in West Persia. The practically universal corruption of government officials completes the picture, and when the natural obstacles of drought and intense sun are considered, the future of Persian forestry seems black indeed.

So much for the dark side, however. Now let us look at the silver lining, for there is a silver lining.

First of all, there is considerable proof of there once having been forest growth of some sort in the country:

1. At an elevation of perhaps 1,500 feet above the level of Lake Urumia (a total elevation of about 5,500 feet above sea level) the author found scrubby junipers growing widely scattered on the driest kind of rocky slope, facing the hot southern sun, and entirely unsheltered or unwatered. Rough hacking off of the branches and stems of these trees—done by fuel gatherers probably—led to the thought that if these trees were left alone by men they would produce stands. The largest of these trees was about eight inches in diameter at the stump and was bearing a heavy crop of seed, a proof of the tree's ability to establish itself well and grow vigorously.

2. In two places at least the author saw trees judged to be a variety of haw growing on unirrigated mountain land. One had attained a d.b.h. of perhaps 10 inches and a total height of about 30 feet. One

group of these haws were protected from destruction by the fact that they grew near the shrine of a local Moslem saint and were considered holy trees. All were growing without irrigation.

3. Wild almond trees were found growing at the foot of a high cliff on a northern exposure on a mountain at an elevation of about 500 feet above Lake Urumia.

4. Small bushes were found growing naturally along a small brook up in the mountains, about 2,000 feet above Lake Urumia.

5. It is the custom of the country for the poor people to go out and cut down all bushes, and even weeds and thorn bushes, anything and everything, in fact, that is not protected by some owner. This work of destruction is clearly seen above in the case of the junipers and has evidently been the custom for countless generations as an easy way for the poor to get fuel for their fires. Trees near villages, where they are watched and protected, grow well on sites similar to sites off in the country where no trees are to be found.

A second encouraging sign is the fact that a crude but real system of primitive forest practice is used by the natives. The timber problems have been worked out as follows:

Wood is needed for charcoal, carpentry, turnery, building material, wagons and carts, saddles, wooden spoons, farm implements and other common uses. (Few natives can afford to burn wood fuel, grass, twigs, leaves and manure being generally used instead.) To meet these demands two varieties of poplar (one the lombardy), two willows, the English or Persian walnut, the oriental plane, and one species of elm are used. Their production is taken care of as follows:

1. *Poplar*. Poplar is used for almost everything, as it is by far the cheapest wood obtainable. As the wood is easily broken, cracks, shrinks and warps badly, the woodwork of a Persian house will strike the newcomer from America as very crude indeed. The practice in growing poplar makes use of the natural habit of the tree in growing tall and of small diameter. Planting cuttings of poplar in long single or double rows bordering little irrigation ditches, often around the borders of gardens in the towns or cities, often set not two feet apart, the trees are allowed to grow a few years naturally. Then they are crimmed of all branches for perhaps nine-tenths of their total height and thereafter kept trimmed, the result being a long, slowly tapering stem often 75 feet in height, but less than a foot d.b.h. Being watered carefully, these poplar plantations grow rapidly, 15 years being about

the duration of the usual rotation. The long, round, peeled trunks of these trees are then just what are needed for beams and rafters in the houses and for narrow boards. There is great economy of space in growing the timber in these long, narrow, closely spaced rows, the crowns being kept trimmed high enough to be out of the way and the trimming also preventing the formation of large knots on the stem as well as furnishing valuable fuel for the bakeoven in the form of leaves and small branches. The timber when grown in this manner is also close to the home of the owner and so is easily protected. The irrigation ditch usually is really carrying the water for some other purpose, but is used for the timber as it passes by. After cutting, the reproduction by coppice is allowed to grow and is thinned out as needed to conform to the general plan of the system. Altogether the plan of management is surprisingly efficient and economical.

2. *Willow*. The willows are used for three special purposes for the most part. First, as shade trees planted in rows along the sides of the roads and streets, not planted for the purposes of shade primarily, but serving the purpose just the same. Second, as cheap fuel and wood for charcoal. Third, for pipes, the hollowed stem being sometimes used to carry water down from the irrigation ditches to the little horizontal waterwheels in the mills, and as little water bridges to carry the stream of one ditch over another ditch. The method used in producing this wood is almost as efficient as that used in growing poplar. Stakes of willow, freshly cut and 10 or 15 feet long, are stuck into the ground about 20 feet apart in a row on each side of the road or street. The bark being left on and water being run along the gutter periodically to water them, the sticks take root below and sprout in a sort of broom above. In three years the branches are cut off close to the trunk—they all come out close together near the top of the stick—leaving the stem bare. The branchwood is sold for fuel and the following spring new sprouts appear where the old ones were cut off and for three years more shade the road before being cut again. As time goes on the trunk keeps growing in size and when large enough and hollow, as they often become, are available for pipes, although this use is only occasional, the usual practice being to continue the pollarding indefinitely.

3. *Plane*. The oriental plane trees supplies the country with its common hardwood but owing to its high cost, little of it is used. It is grown under the same system as that used for the poplar but is

sometimes allowed to grow much larger, and reaches great size. The beautiful avenue of the College Compound of the American Mission in Urumia contains trees over 100 feet high and three feet through on the stump, but for the most part the plane is not allowed to get so large.

4. *The Elm.* A small-leaved species of elm is found, used only very occasionally, and then only for purposes requiring a tough wood. Very little elm wood is used. It is grown singly or in little woodlots, periodically watered and cut before attaining great size. Elms are not often seen except in front of mosques or as ornamental trees in gardens of the wealthy.

5. *The Walnut.* The Persian walnut, miscalled the English walnut, grows naturally in Persia, it being close to the optimum range of the tree. It is used for its nuts and little lumber of this species is seen, although it can be found. Fancy woodwork of any kind, and there is very little of that, is about its only use, although some of it gets into fuelwood occasionally.

In addition to the proceeding timber trees in general use, a number of other species are to be found here and there in gardens. A cedar, imported from Teheran, the capital of Persia, an oak from the country south of Lake Urumia, honey locust, American black walnut, both brought in by the missionaries, box elder, maple, horse chestnut, a blue spruce and acacia are all present, but of course always under irrigation. The wood of none of these appears on the market.

A third hopeful sign, unseen by the author, but heard of from most reliable sources, is the presence of some actual forest growth located in at least two general sections of the country. A trip was contemplated to one of these natural forests but circumstances prevented.

A final hopeful sign, and by no means the least hopeful, is the breaking down of some of the religious bigotry of the Moslems and a looking to better things from America and Europe by all classes, races, and creeds. This is markedly noticeable among the young men educated in the mission schools. The idea of reforesting the country was seriously brought up to the author by one man who had been appointed as a commissioner of agriculture and forestry by the Shah. Nothing had actually been done, but the incident revealed the fact that the idea of forestry has seeped through even to that far-off corner of the earth.

There are three pressing needs in West Persia which call to the forester at present:

1. The introduction of better timber trees for use under irrigation.
2. The solving of the fuel problem by the introduction of fast-growing trees of high fuel quality, thus bringing about an abundance of cheap fuel, and thus liberating the valuable manure for farm fertilizer.
3. Experimental work on unirrigated areas for the purpose of finding the best species for the ultimate work of reforesting the whole country.

Along with these three pressing needs should go:

1. General public propaganda for forestry.
2. The introduction of elemental forest education in the mission schools.

A non-political Forestry Commission for all of Persia should be created as soon as possible, drawing largely from the American missionaries for personnel. The problems to be brought before such a body would include:

1. A national forest survey.
2. A national land classification.
3. The establishment of a bureau of forest investigations.
4. The creation of national forests, forests laws, etc.
5. The creation of a Persian national forest service, after the pattern of the U. S. Forest Service, to protect and manage the national forests, and direct the entire work.
6. The establishment of a more advanced forest school, preferably under one of the mission schools, subsidized by the Government perhaps, to train foresters for the work.

At present the political situation in Persia is most uncertain, the destitution in West Persia is still intense, and the whole region is in confusion, more or less, as is all of the Near East. But ultimately, and probably before very long, things will settle down and the opportunity for the introduction of forestry into another portion of the earth will open wide its doors and send out its call for help in the form of trained men who wish to work in an entirely new field, entirely untouched by foresters.

THE USE OF STAND GRAPHS IN DETERMINING THE LIMITATION OF CUT

BY HERMANN KRAUCH

Forest Examiner, U. S. Forest Service

The term "good forestry" implies that the forests are managed on the basis of a "sustained yield." In order to accomplish this, it is of course necessary to have data showing the composition and rate of growth of stands. Assuming that such data are available, it is possible to determine the amount of timber which can be periodically removed from a given area, in conformity with the principles of management. Knowing the stand per unit of area, the percentage of timber that can be cut, is readily computed.

The application of this principle in the field is, however, not so simple. Unless the forester records and computes the volumes of trees retained during the process of marking, he has no satisfactory means of judging the amount of timber he is leaving. In ordinary practice such procedure is not feasible. The following method is therefore suggested, as having a possible application in the execution of National Forest timber sales. In order to describe the procedure, an actual virgin stand will be considered.¹ The tabulated data for this stand show the merchantable volume (board feet) by inch-diameter classes, and for young (black jack) and old (yellow pine) separately. From these figures the accompanying graphs were compiled.

The upper graph shows the composition of the stand according to percentages of young (black jack) and mature (yellow pine) trees in volume b. f. The amounts per acre are also indicated. The other graphs show the percentages of trees in each diameter class and also the corresponding percentages in volume. The values are plotted on a scale of 10 inches, thereby making calculations a simple matter of measurement.

Let us suppose that a tract of yellow pine timber, of which the example cited is typical, is to be marked for cutting. The field meas-

¹ This area consists of 40 acres of virgin and very mature yellow pine in the vicinity of the Ft. Valley Experiment Station, Flagstaff, Arizona.

STAND OF WESTERN YELLOW PINE

Black Jack "850 B.F. per acre

11%	89%
Total Stand 7800 B.F. per acre	

Yellow Pine " = 6950 B.F. per acre

"BLACK JACK"

Percentages of trees (number) by Diameter Classes

12"	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

Percentages of volumes of trees by Diameter Classes

"YELLOW PINE"

Percentages of trees (number) by Diameter Classes

12"	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

Percentages of volumes of trees by Diameter Classes

0 SCALE 10
PER CENT

urements show that there are 7,800 b. f. of merchantable timber above 12 inches d. b. h. per acre, which is divided between black jack and yellow pine, as indicated. If all of the yellow pine were removed and all of the black jack retained it would result in the cutting of 89 per cent and a retention of 11 per cent of the stand. Obviously, the amount of timber retained per acre would be relatively low. To retain all of the larger black jack and to cut all of the thrifty yellow pine might be silviculturally undesirable.² Let us therefore assume that all of the black jack above 22 inches d. b. h. should be cut and that all of the yellow pine below 22 inches should be retained. Measurement on the graphs shows that 73 per cent of the volume and 92 per cent of the number of black jack would be retained. Likewise, measurement on the graphs shows that 9 per cent of the volume and 29 per cent of the number of yellow pine trees would be retained. The total amount retained per acre is therefore computed as follows:

$$\text{Black jack} \dots 850 \times 0.73 = 620 \text{ b. f.}$$

$$\text{Yellow pine} \dots 6950 \times 0.09 = 625 \text{ b. f.}$$

$$\text{Total} \dots \dots \dots 1245 \text{ b. f.} = 15.01 \text{ per cent of total stand.}$$

If this particular stand were marked to the diameter limits indicated, an approximate retention of the corresponding volume would be secured. Conversely, the diameter limits to which timber should be marked in order to retain a given volume per unit of area can be ascertained.

MODIFICATION OF METHOD FOR SELECTION SYSTEM OF CUTTING

In stands where strict cutting to a given diameter limit can be followed, the method outlined should be very feasible. Where a selection system is practiced, however, as in the yellow pine type of the Southwest, some modification is necessary. The following is therefore suggested.³

² Since marking in the yellow pine type involves a selection system, both black jack and yellow pine are often retained, regardless of diameter class.

³ This example is merely cited for illustration and is not necessarily the limit desired. Moreover, owing to the fact that a selection system is practiced, other diameter classes and a different volume per acre would result. The modifications necessary to meet the demands of a selection system are discussed under a corresponding caption.

1. Determine the approximate diameter limits to which black jack and yellow pine would be cut, in conformity with the volume per unit of area to be retained.

2. Tally by diameter classes all trees which are retained and cut, but which do not fall within the prescribed limits. Since the number of trees which would fall outside of the diameter limits should be relatively few, no very large amount of extra work should be involved.

3. Compute the volumes of trees retained and cut outside of diameter limits and add the balance (volumes of trees cut minus volumes of those retained, or vice versa), to the estimated volume to be retained.⁴ If more than the desired amount to be retained results, a re-mark corresponding to the necessary reduction can be made.

POSSIBILITY OF APPLYING METHOD

Obviously, the method described cannot be applied unless the composition of a stand is known. To measure a whole stand previous to cutting would be the most feasible plan, but it is probably not economically warranted. The selection and measurement of trees on typical sample plots should, however, furnish the desired data. This ought to apply especially in stands of uniform density.⁵

⁴ While no data are available to prove the assumption, it seems probable that the balance resulting from cutting and retaining trees outside of the prescribed diameter limits, will be small.

⁵ Even in the irregular stands of western yellow pine this seems to apply. Comparison of composition of stands on sample plots with that of more extensive areas shows them to be quite similar. This does not imply, however, that the volumes per unit of area are the same. Neither is this to be expected, owing to the large and irregular extent of unstocked area. If the composition (distribution of diameter classes) is the same on sample plots as on more extensive areas, the essential data for the application of the described method is obtainable, because we are concerned with management on a volume rather than on an area basis.

THE OUTLOOK FOR EXTENDING AMERICAN LUMBER TRADE IN ITALY

BY RAPHAEL ZON

There appeared recently several conflicting reports as to the lumber situation in Italy and the opportunities for large timber exports there from the United States. For this reason an official report on the possible sources of Italian imports, prepared by the National Royal Institute of Italy in 1919 should be of interest to American foresters and the lumber trade.¹

Italy before the war consumed annually 3,600,000 cu. m. (in the log) (900,000,000 board feet) of softwoods, and about 1,600,000 cu. m. (400,000,000 board feet) of hardwoods, or in all, 5,200,000 cu. m. (1,300,000,000 board feet) of sawlog timber. Of this 3,800,000 cu. m. (950,000,000 board feet) were imported from other countries, while home production did not exceed 1,400,000 cu. m. (350,000,000 board feet), or a trifle more than one-fourth of the entire country's requirements. This dependence of Italy upon timber importations becomes even more striking if we consider the requirements for softwoods only. While the annual consumption of softwood timber is 3,600,000 cu. m. (900,000,000 board feet), the home production of softwoods is not more than 400,000 cu. m. (in the log) (100,000,000 board feet), or scarcely one-ninth of the total requirements. In other words, 3,200,000 cu. m. (800,000,000 board feet) were, under normal conditions, imported from abroad. Of this 2,800,000 cu. m. (700,000,000 board feet) of timber imported annually before the war was of softwood lumber, and about 400,000 cu. m. of pulpwood.

The situation was better with regard to hardwoods, as the home supplies of hardwoods are much more plentiful. Thus of a total annual consumption of 1,600,000 cu. m. (400,000,000 board feet) of hardwoods, only 600,000 cu. m. (150,000,000 board feet), were imported from abroad and 1,000,000 cu. m. (250,000,000 board feet) were produced within the country. A total home production of even

¹ Per L'approvvigionamento del Legname nel dopo Guerra. Prof. A. Serpieri, R. Istituto Superiore Forestale Nazionale, Firenze, 1919. (Providing for timber after the war). Translated by Winifred Whaley.

1,400,000 cu. m. (350,000,000 board feet) a year, in the opinion of the Italian foresters, exceeded the normal capacity of the forests; i. e., that even at such a rate of cutting the forests were overcut. Such was the situation before the war.

The timber situation became more serious after the war. While during the war the consumption of wood for ordinary purposes was greatly reduced, the war activities, on the other hand, called for large amounts of timber for defensive purposes, barracks, aviation, crating, and other military uses. The Royal Institute computed the average annual consumption of timber for military purposes for the period of the war at from one and one-half to two million cu. m. (in the log) (375 to 500 million board feet). Assuming that the normal annual consumption prior to the war, excluding military needs, was reduced to one-fourth, or to about 1,500,000 cu. m. (375,000,000 board feet), and adding to this the military requirements, the annual consumption during the war amounted to about 3,000,000 cu. m. (750,000,000 board feet). Of this only a comparatively small part was imported from abroad. The drain therefore fell upon the domestic timber supplies. How small were the imports of timber during the war is shown by the fact that on an average for the three years of war, 1915-1917, there were imported only 670,000 cu. m. of logs (167,500,000 board feet), and about 230,000 cu. m. of wood pulp (also in the log), or in all 900,000 cu. m. (225,000,000 board feet), as against 3,800,000 cu. m. (950,000,000 board feet) in the years just preceding the war. During the period of war, therefore, Italy was compelled to cut, instead of 1,400,000 cu. m., 2,100,000 cu. m. (525,000,000 board feet), or in other words, during the war the forests were cut one and one-half times more than during the years immediately preceding the war. The drain upon some of the forests was even greater than these figures would indicate. Not all forests were subjected to the same heavy drain. Thus the hardwood forests, of which Italy has a comparatively large area, were affected very little by the needs of the war, and in certain regions did not feel the effect at all. The greatest pressure was centered on the coniferous forests especially within the war zone. The cutting in those forests during the war doubled and even trebled. In addition to the direct damages of the war, there was great waste due to hasty and improper utilization made under pressure of immediate need. The Italian foresters feel, therefore, that if the demands of the next years for timber are to be met by the cutting of

native timber without large imports from abroad, the Italian forests will be utterly destroyed, especially the coniferous forests. And this may very readily happen if with the resumption of utilization for civil needs importation from abroad continues to be scarce and its cost high.

Italy is thus face to face with the dilemma of either making deeper inroads into her already depleted home supplies, or finding some cheap sources of raw material abroad. All the indications are that Italy will find, and is already finding, such sources of timber supply close at home, chiefly around the Adriatic and Black Seas.

First of all, the territories newly added to Italy are fairly well wooded, particularly with coniferous forests, and their normal annual production of wood is close to 640,000 cu. m. (160,000,000 board feet), of which half a million is coniferous timber. The normal annual cut for the different newly added territories is about as follows:

	<i>Annual cut, cu. m.</i>
Trentino	268,028
Alto Adige	267,595
Goriziano	33,536
Trieste	545
Istria	22,778
Dalmatia	46,936
Total.....	639,418*

This is a considerable annual addition to the total timber production of Italy, particularly as the increase is in the coniferous wood, which is the scarcest. Still, with the additional territories the annual timber consumption has also increased and the problem is only partially solved. Some other sources of importation must be found and in larger quantities than in the pre-war period, on account of the greater need of industry and the necessity¹ of allowing the Italian forests to recuperate after the heavy drain of the war.

Before the war softwoods formed more than 80 per cent of the entire import. About 90 per cent of all the imported timber came as sawed timber and about 10 per cent as rough, round, or hewn timber. About 75 per cent of the rough, round, or rough-hewn timber came from Austria, the greater part of it by water or rail. The rest came by sea from the other shore of the Adriatic. Eighty per cent of the sawed timber came from Austria and about 12 per cent from the United

* About 160,000,000 board feet.

States, and the rest from Russia, Roumania, and other countries. A little more than half was shipped by land, almost exclusively from the Venetian frontier. A little less than half came by sea route, mainly Genoa and Tirreno. About seven-ninths of the wood pulp came from Austria-Hungary, Germany, Norway, and other countries. During the last years before the war Germany was surpassing Austria-Hungary in the importation of wood pulp. About three-fourths of the boards came from the United States and one-fourth from Austria. By species the chief sources of supply were as follows:

Fir	Alp regions of Austria
Larch	Austria and Switzerland
Pitch pine	United States (South)
Beech	Bosnia, Croatia, Slavonia
Walnut	United States
Oak	Slavonia, Croatia, Bosnia
Ash	Hungary, Slavonia, Carniola, and Albania
Maple	Carniola and Croatia

Thus before the war the countries which formerly made up the Austro-Hungarian empire and now form parts of Jugo-Slavia, Roumania, and other newly created states, and to some extent the United States, were the chief providers of lumber to Italy. During the war, from 1915-1917 inclusive, round or hewn timber came largely from Switzerland (about four-fifths), the rest from France. Saw timber came from Switzerland (more than half), and from the United States (two-sevenths); wood pulp from Sweden (about one-half of all the imports), and from Norway (one-third).

Italy, realizing its dependence upon timber from abroad, was fully alive to the situation even before the war and tried to meet the problem by acquiring large forest properties or stumpage in Tryol, Carinthia, Styria, Carniola, Transylvania, and Bosnia. The Italian lumbermen not merely invested in the forest land and stumpage, but actually went into the development of Austrian timber resources, built roads and camps for the workers and organized the complete process from cutting the wood to sorting the product ready for the market. In this way the Italian industries sought before the war to assure themselves of a considerable part of the needed importations. Under normal conditions the needs of the Italian industries would be met by free industrial initiative. Individual initiative in the period of readjustment is unable to cope with the problem and Government assistance is con-

sidered essential. Private industry in Italy, as elsewhere, is still in an unsettled state. The foreign countries that supplied most of the Italian wood are disorganized. The conditions of transportation both by water and rail and the general economic situation of eastern Europe are unstable. The industries therefore need the cooperation of the Government in securing the necessary supplies of timber.

From the neutral or allied countries, such as Switzerland, the United States, and Canada, the Italians do not hope to secure much timber. Switzerland during the war was under the necessity of trading timber for food supplies. With its own limited timber supplies it is unable to hold out very much longer, as under normal conditions Switzerland itself imports timber. At present the Swiss Government is under a contract to the Italian Government to supply a small amount of wood. As to timber from the United States and Canada, the Italians feel that the high prices and the low exchange make the purchase of American timber practically out of the question and compel them to look for sources of timber supplies at more reasonable prices and in countries where the rate of exchange is more on a level with their own. The present tendency, therefore, of the Italian industries and Italian Government is to seek for a source of timber in the countries lying around the Adriatic and Mediterranean; in other words, in the countries which have recently been separated from Austria-Hungary and also in such countries as Roumania, Ukraine, and the Caucasus. They also feel that the German states of Austria, from which Italy obtained, before the war, the greater part of her fir timber—Tyrol, Styria, Carinthia, and other provinces—should deliver, as a part of the war indemnity for a series of years, a certain quantity of wood, great reserves of which must have accumulated in those provinces during the war because of the stoppage of all export trade. They think that this is very easy of accomplishment as most of the forests are state property over which the government has complete control. Jugo-Slavia, which now includes Serbia, Montenegro, Bosnia, Slavonia, Croatia, and Carniola, comprises great forest wealth, both of softwoods and hardwoods. It is a country chiefly agricultural and wooded, which in the natural course of development will be opened up to foreign trade, exchanging forest products for Italian manufactured goods. These forests are also largely public property. In the past when these countries were parts of Austria-Hungary the Austrian Government gave extensive forest concessions to the wood industries of Germany

and Hungary. It is very probable that the Italian Government can now obtain from the present government of Jugo-Slavia similar concessions for the Italian industries on conditions and prices which private individuals would be unable to obtain. Italian capital is already invested in large amounts in forest properties in those regions and such concessions would stimulate the Italian lumbermen to resume their development work there interrupted by the war.

New sources of cheap timber are also being looked for in Roumania and Russia. Before the war the Italian importations from Roumania and Russia were rather small, but were on the increase, plainly indicating the possibility of greater future development. Roumania's absorption of Transylvania made it an important source of timber supply for Italy. Italy is not willing to find herself again in a position in which she was before the war, where she had to depend entirely on Austria-Hungary and the United States for her lumber. The Italian Government therefore is expected to keep close watch over the markets of the Black Sea and the lower Danube and to investigate thoroughly the less-known forest regions in those sections in order to be ready to take the best possible advantage of them. Albania is also included among the countries which are to be investigated as a possible source of cheap timber.

Briefly, the whole present economic tendency of Italy as far as sources of raw materials are concerned, is, in diplomatic language, an orientation toward East rather than toward West. Italy no longer expects to secure the bulk of her raw products from the West, but is seeking them in the countries lying to the east of it, chiefly around the Adriatic and Mediterranean Seas. This may explain the tendency toward an economic "rapprochement" with Jugo-Slavia. Italy was also the first of the great European powers that resumed trade relations with Russia. To carry out this economic policy it is planned to create a special bureau whose functions would be technical and commercial research and general information; this bureau would keep in close touch with the Italian domestic markets and foreign exporting markets, collect and compile statistics, and, through the laboratories of the Royal Forest Institute, make technical tests of the new kinds of timber that the new sources of raw material for Italy may provide.

This tendency could be clearly foreseen even before the war.² In the face of these facts one needs unbounded optimism not weighted

² Lumber Markets of the Mediterranean Region and the Near East, by Raphael Zon. Department of Commerce, Miscellaneous Series No. 51.

down by the realities of life to claim that "Italy is looking to the United States as the natural source of an important part of its future lumber needs, and the amount that the United States will ship to Italy will depend upon the enterprise, initiative, and skill with which this market is developed."³

Similarly unfounded appears to be the statement that the sentiment engendered against Austrian products (during the war) will militate against reentrance into and reexploitation of the Italian lumber market. The provinces which contained the forest wealth from which Italy derived the bulk of its lumber import before the war are no longer a part of Austria today. Some of these regions were never antagonistic to Italy and there is no nationalistic or racial prejudice which would prevent an exchange of commodities. This is confirmed by a recent statement on the lumber situation in Italy by our American Commercial Attaché, Alfred P. Dennis, at Rome. According to Mr. Dennis, the Italians will buy their lumber where they find it best and cheapest, irrespective of the sources of the supply. The Italians, at the present prevailing prices for American lumber, cannot afford to buy lumber in the United States, especially at the present rate of money exchange. The Italians are expecting to find a new field on which they can draw for their lumber needs in the Caucasus or the "Republic of Georgia," rich in mineral and forest resources where they hope to acquire the dominant economic influence. They have already established saw-mills in Albania, richly endowed with heavy stands of timber, and are drawing upon the vast forests in the provinces newly added to Italy as a result of the war. Italy may look to the United States for some heavy timbers for construction in sizes and lengths which she cannot obtain elsewhere. The bulk of nearly all other grades of lumber, however, will undoubtedly come from what was once Austria-Hungary and other Mediterranean countries lying to the east of Italy.

³ The Lumber Market in Italy and Reconstruction Requirements, page 7, Special Agents Series No. 182. 1919.

VOCATIONAL FORESTRY EDUCATION

BY JAMES B. BERRY

The Vocational Education Act (Smith-Hughes, 1917) has as its object the promotion of vocational training of secondary school grade in agriculture, home economics and trades and industries. The act carries in appropriation, after attaining its maximum in 1925-26, of \$7,000,000, which is allotted to the States on a basis of population and which must be offset by an equal amount for the same purposes by the States or communities securing the benefits of the legislation. The act is administered by a Federal Board for Vocational Education, but the execution of the State program is placed in the hands of a State created board, the State Board of Education being designated as a rule. Of the total appropriation one-seventh is for the maintenance of teacher training departments for the preparation of teachers of vocational subjects. In general the teacher training departments are created in connection with existing State institutions.

Vocational forestry education falls within two fields; farm forestry, maple sugar production, and general silviculture being classed under the head of agriculture; lumbering, paper making, wood distillation, and wood manufacture coming under the head of industries.

Vocational education in agriculture is well organized in most of the States, the inauguration of vocational agricultural departments in high schools proceeding as rapidly as teachers could be prepared. There are at present several hundred agricultural high school departments and the possibility of the near future is that such a school will be created in every rural community in the United States. In addition to fifty per cent of the school day during the high school course being devoted to vocational agriculture the act requires that there be six months of supervised farm practice. Many States provide in the State plan for farm forestry as a part of vocational course and State boards generally should be educated to an appreciation of the importance of this subject. In addition to the high school work many of the States are organizing special short-course schools for those who are engaged in farming and a demand is frequently created for a few 'days' instruction in the management of the woodlot. In either type

of school the supervised practice may include actual woodlot operations. Where a demand exists for trained foremen in planting, nursery or other silvicultural activities it would be possible to provide instruction for these men. Provision can be made in like manner for the further vocational training of the employees of the Federal and State forestry and park departments.

In the line of industrial forestry very little has as yet been attempted. On the Pacific Coast several vocational schools in lumbering are meeting with success, one school limiting its field to the training of foremen for the various logging operations. In New York State a vocational school has been organized in connection with a pulp mill. The chief obstacle to the progress of the work has been the lack of qualified teachers. In general, teachers of vocational subjects are required to have had several years' practical experience in the vocation in addition to their technical and professional training.

Under the provisions of the act it is possible to establish vocational schools in connection with every large lumbering operation, wood-working industry, paper mill and wood distillation plant in the country wherever the minimum enrollment can be obtained. Such schools may be day, part-time, or evening and it is frequently possible for one teacher to instruct several classes in a community.

Vocational forestry education opens up a new field for foresters with the required preparation, since hundreds of teachers of lumbering, paper making, and other vocational forestry subjects will be required each year. Forest schools must take an active part in the movement, however, if it is to prove a success.

REVIEWS

Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership. Report of the Forest Service in Response to Senate Resolution 311. 1920. ,

During the last eighteen months there has been a very lively public agitation throughout the country regarding the forest question. This is due in part to the movement for a National Forest Policy, promoted by the foresters of the country. Chiefly it is due to the skyrocketing of the prices of lumber, the difficulty and frequent impossibility of obtaining materials promptly and in the quantities needed, and the consequent hardship to all wood consumers. The widespread public uneasiness and agitation over the forest and lumber question were reflected in a resolution of the United States Senate, introduced by Senator Capper of Kansas, calling upon the Secretary of Agriculture for the facts regarding the situation. The resolution, in its preamble, refers to the rapid depletion of the forest resources of the country, and requests such information as is available regarding the depletion of the timber, pulpwood, and other forest resources, and the relation of this depletion to the current high prices, to the problem of lumber export, and to the concentration of ownership of timber lands and of lumber manufacture. The report of the Forest Service, in response to this resolution, was submitted June 1, 1920, carrying the long, though descriptive, title at the head of this review. The report has already attracted a great deal of attention, being ordinarily referred to, for short, as the "Capper Report."

The Capper Report is in many ways the most important contribution to the economics of forestry that has been published since the reports of the National Conservation Commission in 1908. During the last decade many facts about the condition of our forests and the lumber industry have been published from various sources. A good deal of this material was based on the studies of the National Conservation Commission in 1908; some of it was applicable only to special regions and special problems; in many cases the information used by different authorities was contradictory. The Forest Service has now brought together in concise form the best information available and has interpreted it in light of the post-war economic and industrial conditions.

The Senate resolution, while mentioning several specific lines of inquiry, is so broad in scope that the Forest Service has been able to present a very comprehensive survey of the forest problems now faced by our Nation.

For the first time in our history the country begins to realize the important part that wood products play in our industrial life. Our forests have been so vast that it has always been possible to secure plenty of raw material at reasonable prices. As one region has been cut out, other regions have been opened up and the market amply supplied. It has required a crisis like the great war, with its after effects, to reveal our basic dependence on timber and wood products, and also to reveal the extent to which our forest supplies have already been depleted.

We have experienced a real shortage of lumber. The Capper Report graphically describes how this shortage has reacted to embarrass many industries and individual users. The first effect of it was to send up prices to the highest point ever known. During the war lumber production was greatly reduced, existing stocks at the mills and in the yards of distributors were drained down and often practically exhausted, and the logging and manufacturing industry was disorganized and unprepared to meet the large demands resulting from the resumption of industrial activities following the armistice. Deficiency of adequate and efficient labor, frequent shortage of cars, and unfavorable conditions of logging were added difficulties that retarded recovery and held down production. With little or no surplus in the yards consumers were dependent on current production and this below normal and far below the real needs of the country. Under such conditions there was sharp competition among different wood users for the available raw material. As expressed in the Capper Report, "Competition during the past few months has been very largely among consumers for generally inadequate supplies. Under any conditions such a reversal in the fundamental situation would result in high prices; but the shortage and demands have been so extreme that wholesome restraints as to prices which might safely be paid have been removed, and in many cases it has been possible to pass on to the consumer, and even to augment, almost any price increases." It was an auction market run wild, with prices that bore no relation to cost of production but depending only on the frantic demand of builders and other users to secure raw materials needed to carry out their contracts.

The Forest Service did not undertake anything like a complete investigation of lumber prices. The time allotted by the Senate for the report did not permit this; nor was it essential. The Service was sufficiently in touch with the situation to present its salient features and to give illustrations of price increases that were typical. Most startling and most disturbing was the increase of price of materials used for necessities such as house construction. An increase of 300 per cent in the cost of lumber for high-class furniture is not a serious matter contrasted with a similar increase in the case of material needed in building, especially at a time when the public is suffering from an acute housing problem. Illustrations of the serious price situation and its consequences are given in the report in the discussion of several of the important wood-consuming industries, general building and construction, farming, the railroads, the furniture, veneer, handle, vehicle and agricultural implement industries, and the newspapers.

The high prices of lumber and wood products have been a serious burden and have reacted in a very important degree to handicap the process of readjustment. While in building, high prices of other materials, increased labor cost, and transportation difficulties have played also an important role, the shortage and high price of lumber are often the dominant factor that has acted to retard home building. The problem is serious in the cities and small towns; it has been equally so in handicapping the farmers. As summarized in the Report, "Livestock raising and dairying seem to be hardest hit, because of the large barn equipment and shelter necessary. It is reported that heavy losses of implements and crops are resulting from lack of proper storage facilities. In some of the newer sections it is even reported that farmers who have not yet reached a stable financial basis are leaving the land because of the cost of new construction. It is reported from all parts of the territory covered that present conditions are tending to lower the standards of living and to make it more difficult to hold on the farm the farmer's own children and desirable classes of labor." This is an official expression of a situation easily verified by any one at all familiar with conditions in rural America.

One could go on almost indefinitely pointing out the effect of high prices of wood products in causing industrial and individual embarrassment. The Capper Report covers several of the chief industries. It could have recited many other situations of less aggregate im-

portance, but nevertheless serious to specified localities. The conclusion is well expressed that "shortages and high prices, accordingly, seriously affect the whole Nation."

Since the Capper Report was prepared there has been a recession of lumber prices. At the writing of this review mill prices of many grades have fallen as much as 35 per cent. Recessions in the retail trade are not as marked; in some cases they have been as much as 20 per cent below the peak of a few months ago. Some of the conditions that caused the great rise of prices still exist and it is probable that prices will continue to be a handicap to our best industrial recovery and advancement.

The Senate Resolution was directed primarily toward the question of forest depletion and its effects, including its influence on lumber prices. For over a year the foresters of the country and others had been calling attention to the continued process of depletion of our forests. The main facts regarding the progress of forest depletion and devastation had already been set forth and reiterated many times. In the public discussion of these facts differences of opinion rapidly developed, especially as to the interpretation of the economic consequences of forest depletion. Certain groups of lumbermen undertook to minimize the situation and to assure the country that the quantities of timber still standing were adequate for many years. It is fortunate that an occasion has been given for a full official statement by the Government regarding the forest situation, for it entirely clears away any grounds for controversy as to the basic facts.

The economic consequences of forest depletion can not be indicated by a mathematical formula. At first glance it would seem as if our country were still well stocked with timber. We are informed that there is still nearly 2,215 billion board feet of standing material. Our sustained needs are estimated at 35 billion feet. It would appear a simple matter of division to show a supply of nearly sixty years, not counting new growth. It is exactly such calculations that have formed the basis of appeal by those lumbermen who urge that our forest problem is not serious. In point of fact this method of computation of our forest supplies does not represent the true situation at all, for it ignores the character of the forests, their location, and their availability to existing industries and individual consumers. Nor does faulty figuring of this kind convey any conception of the economic hardship resulting from the exhaustion of localities built up and sustained by

lumber and wood-using industries and now impoverished by the wastage of great areas of lands that are not suitable for agriculture or other purposes than growing trees.

It should be borne in mind that our country is still using old-growth timber for most uses. Except in a few regions, the people have not accustomed themselves to use the type of lumber that comes from young or second growth timber. Our lumber manufacturing industry, that supplies the general market, is built up on the basis of large quantity production from old-growth forests. The same is true of most of the wood-using industries, including the vehicle, veneer, implement, furniture, cooperage, and even the newsprint paper industries. The transition from the use of high-grade virgin timber to second growth presents many difficulties and many industrial disturbances that locally at least are serious. Any complete inquiry into the condition of our forests involves first the amount of standing timber, its character and availability, second, the amount of second growth now standing that may be counted upon when the old timber growth is exhausted, and third, the subsequent growth from small trees already established or which will come up on cut-over lands.

In the Capper Report the quantity of first-growth timber and second growth of merchantable size are in many cases not separated, due doubtless to inadequate information on this point. The rate of depletion of all merchantable timber shows a condition that is extremely disturbing; more so when one realizes that the second growth is not being spared for later cuttings but a clean sweep is being made wherever the smaller trees can be marketed. An analysis of the data shows that in 20 years most of the large scale operations in the eastern States will be completed. This means that the old timber will be gone except scattered small fragments, as well as the second growth in mixture or immediately adjacent to the present larger tracts.

The question naturally arises whether it will not be possible within a decade or so for people to adapt their requirements to second growth of which there are now considerable quantities of sizes large enough for the saw? Thus the Capper Report tells us that in the southern pine belt there are 29 million acres supporting second growth of merchantable size. Why not draw on that supply when the old timber is cut? Right here is one of the most serious phases of the whole situation. The second growth is also being cut with great rapidity and the more important bodies will be exhausted coincidentally with

the virgin timber. In the South it is being cut over at the rate of $1\frac{1}{4}$ million acres a year. It will all be cut over in 20 or 25 years, as predicted in the Capper Report.

Precisely this same process is occurring in other eastern forest regions, with a result that the present second growth of merchantable size will not be of any substantial service in continuing the period of large lumber production in the East. This means that the East and Middle West, that consumes the larger part of all the lumber of the country, must from now on secure increasing amounts of raw material from the forests of the far West or of other countries.

The forests of the far West still contain a large reserve supply of softwood timber, but no substantial stands of hardwoods. It has been with considerable complacency that the lumber industry has pointed to the Pacific and northern Rocky regions as a source of raw material to meet our country's needs and the solution of our forestry problems. To be sure, our nation is fortunate to have this large supply of timber and especially to have a large area of lands owned and controlled by the public. But it by no means constitutes a solution of our forest problem and will not prevent the hardships to the consumers of the East whose nearby resources are being swept away so rapidly.

The Capper Report informs us that the forests of the Pacific States and Rocky Mountain region carry about 1,364 billion feet of timber. This is an impressive quantity when considered without reference to quality, location, cost of production, and transportation. The timber is there and a large part of it will ultimately be used, but at what a cost to the consumer of lumber three thousand miles away. The economic availability to the nation as a whole of these supplies takes on a new significance when one appreciates the rapidity with which the more accessible tracts are being lumbered and are likely to be lumbered in the immediate future, and also the increase of local requirements that will follow the certain development of agriculture and industry in far western regions. A western authority is quoted in the Capper Report as predicting that, without any allowance for the expected increased rapidity of cutting, the virgin timber on the private lands of western Washington will be cut in 35 years and in eastern Washington in 20 years; and that considering the increased drain of the coming years the private virgin timber of the State as a whole will be gone in 20 years unless there is a change in forest policies.

The economic consequences of forest depletion comprise both the hardships that result from the inability to secure adequate supplies of wood materials at reasonable prices, and the blighting effect on communities and regions of turning a large part of the land into unproductive wastes. Our country has had a taste of what shortage and high prices of forest products means. Forest depletion perpetuates that condition. And we already have illustrations in great numbers of the local effect of impoverishing a community by forest devastation. In either case the effect is to retard and often block the building up of the country.

A thoughtful student of forest economics in reading such statements as I have reviewed is apt to reserve a question as to whether the condition described is not really temporary and that while we will have to face difficulties of readjustment and perhaps pay a big freight bill to get Douglas fir and western pine from the West, after all we have an immense area in the East actually growing small trees that should within 20 to 40 years be ready to furnish timber in large quantities. We are told that we have 463 million acres of forest land not including low grade scrub land, and that of this 137 million acres still carries virgin timber. What of the remaining 326 million acres?

If our forests had been adequately protected and even the simplest methods of forestry used in the cuttings, we would today be in a different situation. But fire and timber mining have laid waste 81 million acres that are not being restocked with forests at all. On the balance such growth as occurs is in many cases of low grade and of little potential value except for cordwood and round wood uses. On the basis of actual fibre production we are really growing a great deal of material, but a large part of it is little better than an encumbrance on the land. It is estimated that of material suited to saw timber we use and destroy five and a half times what is being grown; and that on the basis of the cubic contents of wood regardless of usefulness, we grow only one-fourth of what we use and destroy. In short, we have the land to produce by growth enough really to meet the demands of the future, but we are failing to do so. We are using up our capital stock and progressing steadily toward forest bankruptcy.

The unfortunate feature of the situation is that we are not taking steps at all adequate to stop the destructive processes going on in the forests. We have not yet mastered the forest fires; and the number

of acres of private lands on which the owners are undertaking to use methods that would secure a replacement of the forest after cutting is negligible. The Capper Report states that "The area of idle or largely idle land is being increased from 3 to 4 million acres annually as the cutting and burning of forests continue." In spite of the efforts of the past years in forestry, our problem especially as related to private forests is unsolved, and there are required new measures more effective than heretofore employed to make real and effective headway.

The Capper resolution not only made inquiry about the facts relating to the depletion of our forests, but it also requested specific information as to the relation of forest depletion to the current high prices of materials. In reply to this inquiry the Forest Service report presents an exceptionally able analysis of the movement of lumber prices during the war period and of the causes for the changes, and points out the part played by forest depletion as an influencing factor of importance. The violent upheaval of the lumber market that occurred in 1919 and 1920 was of course not the result of any sudden change in forest conditions, as many were led to believe by press discussions, for as a matter of fact, during the war the forests were subject to less severe cutting than ordinarily. The prices of lumber rose steadily in response to the same general causes affecting all commodities and there were also special conditions that were the immediate occasion for the sudden skyrocketing of lumber prices. The great demand for lumber, for building and a multitude of industrial uses, following the war "caught the industry not only with its stocks short and broken from war conditions but unable, on account of labor difficulties, lack of freight cars, and bad weather in important regions, to respond rapidly with increased production. Aside from the general causes affecting prices of most commodities, the expansion of credit accompanied by currency inflation and the wave of speculation and extravagance, an 'auction' market would no doubt have resulted from the frenzied competition of buyers to obtain the limited stocks available, wholly inadequate to satisfy current demands." For the conditions that made possible such an aggravated situation as existed we must look deeper and we find that forest depletion was an important contributing factor.

Forest depletion means concentration of lumber production in a few chief operating regions. Already there remains only one such

region of importance for softwoods in the East, namely, the South. In the past the prices of lumber in the general market have been governed by competition between different large producing centers. With the exhaustion of the Lake States as an important source of general utility lumber, it was the competition between the South and Northwest that was the controlling influence on prices. Conditions were already established, through the exhaustion of the old lumber centers near the points of greatest demand, to make the stability of lumber markets depend upon ample production and distribution from the remaining competing sources. Any critical circumstances that interrupted such production are bound to react at once on prices. Labor troubles, bad weather, car shortages, and doubtless in some cases difficulties in reorganization from war conditions, operated to hold down the production and distribution of southern timber. This shortage and the removal of the competition from the South were sufficient to create the conditions that made possible the uncontrolled and inflated lumber market. With nearby local supplies exhausted we are dependent upon distant sources. The more these recede and the more they become restricted, the more easily a crisis in transportation or curtailed production will upset the equilibrium of the market; and this situation will be accentuated with continued progress of forest depletion.

Immediately after the armistice there was a great deal of activity in organizing for a large export trade in lumber. Many persons looked for a greatly increased export trade because of the exhaustion of the forests of western Europe during the war, the disintegration of the Russian lumber industry, and the inevitable requirements for reconstruction in Europe. This occurred at a time when our own industries were short of needed raw materials, and the question was frequently raised whether we should not place checks on lumber export. In the Capper resolution the question is specifically asked, "whether the export of lumber, especially of hardwoods, jeopardizes our domestic industries."

This is a very pertinent inquiry, for our Government has been encouraging the building up of a large export trade in lumber. In discussing the effect of export trade on our industries, the Forest Service report shows that a material increase in the export trade would have a very real influence on the shortage of high quality products. This would be particularly the case with high grade hardwoods that are essential to our vehicle, furniture, and implement manufactures.

Broadly speaking, the answer to the problem of exports is "identical with the remedy for depletion through domestic consumption, namely, not to restrict the use, but to increase the production of timber by getting all forest-growing land at work." The report is not clearly specific in its conclusions as to an export trade policy. It implies the desirability of regulation of certain high grade products and says: "If the export trade in lumber is to be regulated, such regulation should be discriminating and should apply to the grades and products in which a shortage is most imminent and most menacing to domestic industries."

The last specific inquiry contained in the Senate resolution is whether forest depletion tends to increase concentration in the lumber industry, and if concentration exists how it affects or may affect the public interests.

Our general lumber market is chiefly supplied from large manufacturing plants, backed by bodies of timber in large individual ownership. The existence of extensive tracts of forest land privately owned has frequently been a source of uneasiness on the part of the public lest they should constitute the basis for dangerous monopolies. The enormous holdings acquired, especially in the West, during the nineties, provided a basis for this public anxiety and led to a federal inquiry whose results were published in a series of reports of the Bureau of Corporations in 1911 to 1914. It is natural and inevitable that in a period of great market disturbance and high lumber prices, questions would be raised whether the existence of large land holdings are in any way responsible, just as happens in the case of steel, oil, and coal.

The change of Government policy regarding the Federal forest lands placed a sharp check on the acquisition of large bodies of public timber, and the building up of great properties by assembling through purchase lands privately held was by 1910 largely halted by the very burden of carrying long-term timber investments. The Forest Service finds that since the investigation of the Bureau of Corporations the situation as to timber ownership has not materially changed. The present tendency is against the accumulation of very large tracts for speculation. The tendency is rather to put the timber on an operating basis. In some cases the timber holders are becoming operators, in other cases new interests are purchasing from the large holders or consolidating tracts into desirable operating units. There appears therefore no marked tendency toward monopoly merely through the extension of individual timber ownership.

Recent changes have been chiefly in the direction of a new and more effective organization of the lumber industry, especially through a more highly organized control of saw mills and lumber marketing by groups of operators. The industry was proverbially individualistic in character, with thousands of manufacturing units each operating with little regard to the others or to general industrial conditions. In many ways the industry was the most highly competitive in the country. There is now "a distinct tendency, particularly in the western States, toward concentration of a considerable group of mills. Such control may be exercised through varying degrees of stock ownership, bonding or other financial relations, or affiliations of one form or another. These operating groups range from two or three sawmills to twelve or more with a combined cut of from two to three hundred million board feet yearly up to a billion feet." The report calls attention to the fact that this tendency toward more large and powerful operating groups is but partial and that the number of sawmills operating as independent units is still very large and still manufactures the greater part of the total lumber cut. Yet "as regards the principal remaining timber resources of the United States in the West, the present tendency is unquestionably toward a closer concentration of lumber manufacture in large units than has existed hitherto."

Another important factor in the reorganization of the lumber industry is the greater financial strength of its different elements. Formerly many operators were struggling under heavy bonded indebtedness and weak financial backing. They were forced to produce lumber continuously no matter what the condition of the market. This was an important influence in maintaining the competitive character of the industry prior to the war. Since 1914 the financial strength of the industry as a whole has been greatly improved. This is due to the retirement of a large volume of bonds, the entrance of new capital, and the elimination of many weakly financed operators. This condition applies particularly to the West.

There has also been more effective organization of the lumber industry along the line of marketing. This is accomplished through sales agencies which handle the output of a considerable number of mills under central control, through the line yard system of retailing lumber, and through the system of wholesale contracting for the total output of certain mills. In some cases these centrally controlled distributing agencies handle very large amounts of material. One is quoted by the report as marketing a billion feet of western timber

annually; another in New York disposes of 200 million feet a year, this representing the product of eleven southern mills. While the concentration of marketing of lumber is still far from complete, the report speaks of the movement as "undoubtedly the most pronounced feature of concentration in the lumber industry from the standpoint of tendencies in its development and bearing upon the interests of consumers."

Other features of the general reorganization include activities of trade associations. These include the movement for the adoption of uniform accounting systems, the development of trade-marks and guarantee of quality of lumber products, the distribution of information regarding current industrial conditions, the preparation and distribution among members of associations of prices received in lumber sales, and so on.

All of this tends to give the industry greater cohesion and makes for general industrial strength and efficiency. All along the line this means an increasing tendency to concentration and group action. An individualistic, unorganized (often disorganized) industry is rapidly becoming a highly organized industry. With the intensified organization of any industry many elements of competition lose force or are subject to possible control. The blocking up of unorganized timber tracts into operating units, the financial strengthening of the industry, the education of the different operators to conduct their business in light of full information regarding existing stocks, current prices, probable demands, general business conditions and the like, contribute to this, quite aside from concentration in ownership and in manufacture and marketing. That this presents increasing possibilities for centralized or group control that could be used to the public injury goes without saying. These possibilities are pointed out in the Capper Report and at the same time there are shown the influences that tend to continue the industry on a competitive basis, such as the large number of small sawmills, the heavy carrying charges that prevent substantial curtailment of production, and the existence of large bodies of Government timber in the West.

Naturally the factors tending to concentration are accentuated by forest depletion. This is especially the case with the control of high-quality timber. In a region like the South the large bodies of virgin timber are already organized in connection with existing plants. As one operation after another is cut out the number of concerns owning the remaining timber is reduced. In but a few years the remaining high grade softwood timber in the East will be in the hands of a few

men. The same process will occur in the West. As expressed in the report: "Financial strength, strategic location, ownership of the most accessible timber, far-reaching affiliations of one form or another, including in some instances affiliations with transcontinental railroads—all of these factors will tend to give the large interests of the Northwest a greater and greater degree of control of the situation. This control will increase for a considerable period in about the same ratio as forest depletion goes on, and to a corresponding degree will involve the dangers to the public interest arising from a natural monopoly."

Taken altogether the Forest Service report presents a situation with regard to our forests whose seriousness can scarcely be exaggerated. We have already reached the point where the cumulative effects of the past destruction of our forests are being increasingly felt. We are looking forward to an era of industrial expansion, of agricultural settlement of our extensive areas of cultivable lands, of home building on a large scale, of better standards of living and of social relations. Each step will encounter obstacles due to our improvidence in regard to our forests alone, aside from other considerations. We must face the facts squarely and decide whether we will allow the old ways to continue or will take effective action to stop the destructive processes that are unnecessarily depleting our remaining forests. The Nation can no longer ignore the situation. The problem will not take care of itself. Private owners left alone will not meet it. The public must take a hand.

A constructive program for a national policy of forestry is presented in the Capper Report. This is in the main a restatement of the policy that has been urged by the Forest Service during the past 18 months or so. This has been discussed in the JOURNAL so fully that it requires no analysis in this review.

The material in the Capper Report is so voluminous that it gives the impression that the knowledge of our forest resources is more nearly complete than is really the case. A careful analysis of the data reveals innumerable points where the information is based on broad estimates, doubtless arrived at through the use of averages and percentages. Many gaps occur where even estimates can not be made. The available information was adequate to answer the inquiries of the Senate with confidence in the conclusions. The reader of the report should not, however, be misled by the volume of the data in the belief that our knowledge is sufficient for our economic and industrial needs.

The estimates of aggregate quantities of standing timber are probably about right. But our information about its character, the amount of different species and grades, its accessibility, the question of supporting of our various industries, and the relation of the existing resources to the upbuilding of the localities to which they are tributary, is woefully inadequate. This is true also of the actual condition of our cut-over lands and of the growth that may be expected upon them. We have already a great deal of data regarding the habits and rate of growth of individual trees, but comparatively little work has been done in securing the information that would enable one to estimate with confidence what is now being produced or what can be produced over areas of any considerable size.

As an economic contribution the Capper Report shows what we know, and it reveals also the inadequacies of our knowledge. It furnishes an excellent basis upon which to build in our future scientific and economic studies. Broadly speaking, our economic studies should be directed very specifically to the relation of the forests to our several industries and to community upbuilding. This means, of course, the study of the present and future needs of the industries as well as the supply of raw materials. Such studies are very far reaching, touching problems of power, transportation, future markets, labor supply and so on. With such industrial information, the local and general forest studies are given an objective which those heretofore made have often lacked. A competent forest survey would show what we have to meet our requirements; silvical studies would show what we will have under present methods of handling forests and what we might have under right methods; experiment and investigation would lay the foundation of sound practice to build up our forests for future needs. Industrial and scientific information, all taken together, would enable the formulation of such new public policies as might be essential to bring about effective results in forestry.

While the progress in forestry will go hand in hand with the acquisition of more knowledge through research, we do not need to wait for more investigations to put into effect the measures outlined in the national program in the Capper Report. The need has been shown, and our equipment is sufficient to go forward with confidence. Immediate action is imperative, with strong insistence by the public upon a policy that will bring real results.

HENRY S. GRAVES.

The Hardwoods of Australia and Their Economics. By Richard T. Baker. Technical Education Series No. 23, Technological Museum, N. S. W., Sydney. 1919. Pp. 522; colored plates, 135; half-tone figures, 194.

This impressive volume has for its object "primarily to arouse a keener interest in, and to make known to Australians in particular and the world in general, the diversity of hardwoods with which nature has endowed this wonderful continent. 'Especially is it written for the technologist in wood—the architect, builder, saw-miller, engineer, cabinet-maker, and, not least by any means, the forester.'"

The book is divided into three parts. Part I, "written more especially for the student," covers 26 pages and deals with the physical properties of timber under twelve headings, namely, (1) color, (2) grain, figure, texture, (3) taste, (4) scent or odor, (5) wood structure, (6) sapwood, (7) annual rings, (8) weight, (9) tests, (10) durability, (11) crystals, (12) combustibility of Australian timber.

Part II, designed for "the student, the commercial man, and the technologist," covers 354 pages and takes up the individual species of hardwood. "As near as possible the botanical systematic arrangement follows on the lines of that of the English botanists, Bentham and Hooker, and for obvious reasons these war times. With few exceptions only those species actually yielding a good hardwood are enumerated." From a "rough computation" Australia has probably less than 500 tree species, of which far the greater number belong to the Myrtaceæ and the Leguminosæ. The genus *Eucalyptus* is said to cover at least two-thirds of the whole surface and these trees supply the bulk of the hardwoods of both the local and export timber trade of that country.

Part III, written more particularly for the commercial man and the technologist, devotes 100 pages to technological matters. There are four technical articles, namely, (1) determination of specific timbers, (2) nomenclature, (3) seasoning of timber, (4) preservation of timber. Most of Part III, however, covers the uses of Australian hardwoods under the headings of architectural, engineering and miscellaneous.

The most conspicuous feature of this book is the array of excellent illustrations, the 126 chromatic plates showing the natural appearance of the woods. These plates are of exceptional merit. The half-tones

showing forest scenes and uses of woods are also good; the photomicrographs are for the most part only fair.

A casual inspection of the book leaves a very favorable impression; but unfortunately upon closer scrutiny one cannot but feel that the author sometimes failed to make the most of his opportunity. The work could easily have been made more comprehensive without material increase in the size and cost of the volume and various errors and ambiguities should have been avoided.

The title, "The Hardwoods of Australia," leads one to infer that all of the dicotyledonous trees of the continent are covered, when as a matter of fact a small percentage of them are omitted because their wood is not hard. "Hardwood," written as one word, has the generally accepted meaning of "broadleaf" or dicotyledonous wood as opposed to "softwood," which is derived from conifers or gymnosperms. The author has used it, however, with reference to hardness, which is never uniform in woods and which is often widely variable within the same species, and he is accordingly forced to draw an arbitrary line of demarcation where in reality only a twilight zone exists.

The descriptions of the different woods are too brief and sketchy; there is an absence of important detail and balance. The photomicrographs are very helpful in a study of the structure, but they cannot replace careful, detailed descriptions. Moreover, the descriptions of anatomical features as given are not always clear, due to a lax use of technical terms. The most conspicuous example is the constant misuse of "perforations" when referring to "pits." Some other instances of vagueness are as follows: The walls of wood parenchyma cells are said to be "pitted with *single* pits" (p. 19); rays are described as "*unicellular*" (p. 36); rays are "sometimes bounded top and bottom by *vertically celled tracheids*" (p. 38); "the vessels are of *limited divisions* between the partition walls" (p. 183). What is the force of the term "uniseriate" in these sentences: "The rays are numerous, uniseriate, one cell in width" (p. 220), and "the rays are very numerous, uniseriate, nearly always only one cell wide" (p. 231)? The reviewer is in doubt as to just what is meant by wood parenchyma "running with the rays" (p. 338).

In discussing the Olacineæ (p. 66) the author, confusing it with the Oleaceæ, erroneously states that "it is from this family that the timbers of the common ashes (*Fraxinus excelsior* and kindred species)

of other countries are derived." (Cf., p. 316.) On page 112 it is stated that the vessels of *Acacia pendula* have "scalariform apertures" (perforations). This must be a mistake, since not only have other investigators reported simple perforations, but as a matter of fact the occurrence of scalariform perforations has not, so far as the reviewer is aware, been noted in any member of the entire family of the Leguminosæ.

The author is evidently not familiar with anomalies in wood structure and with the literature on that subject, otherwise he would scarcely have referred to the strands of interxylary soft bast in *Strychnos arborea* (p. 319) as "unusually large parenchyma crystal sacs which permeate the wood element in the long axis of the wood, measuring apparently the whole length of a vessel," or have devoted several pages (325-330) to an extended discussion of the well-known anomaly in *Avicennia officialinalis*. He considers this structure unique and says (p. 328) "it is probably the only timber in the world possessing this feature": "The ray parenchyma probably differs from that of every other in the botanical kingdom in that it is not *medullary*," etc.! The rays of this wood are not fundamentally different from those of ordinary woods, though they are interrupted at intervals by layers of bast, a structure that is not particularly rare.

Of the "technical articles" which conclude the book, the most interesting is the one on the uses of Australian hardwoods. This contains a considerable wealth of material and is profusely illustrated. In discussing the common nomenclature the author emphasizes the confusion which has resulted from the lazy method of applying such well known names as "apple," "ash," "maple," "beech" and "mahogany" to Eucalypts and the like. His suggestion of using the scientific name instead is not likely to find favor in the trade.

S. J. R.

The New Ecological Quarterly.

If the first issue of the new Journal of the Ecological Society of America is an index of what the publication is to be it means much for the future of American ecology. It is stated in the foreword that the journal is issued to meet the demand for the collective publication of articles on ecology. Its pages are open to all who have material of ecological interest from whatever field of science.

Heretofore articles in the field of American ecology have chiefly appeared in botanical and zoological publications and in the *English Journal of Ecology*. The new journal will serve a much needed field for American students engaged in many fields of biological science.

Moore, in the presidential address delivered last year before the St. Louis meeting of the Ecological Society of America, stated that all life is controlled by two great forces, heredity and environment and ecology is the science dealing with environment. Accepting this interpretation of ecology, it is related in one way or another to every science which touches life. In former years the biological field was chiefly concerned with the analytical field in which the various biological sciences were approached from separate and more or less remote points of view. In recent years the synthetic field of biology has engaged the attention of scientists and, as Moore states, "many sciences have been developed to the point where contact and cooperation with related sciences are essential to full development." It is evident that in this field of synthetic biology the problems require the work of zoologists, botanists, foresters, agriculturalists, meteorologists, chemists, physicists, bacteriologists and geologists. For this reason ecologists to a far greater extent than is the case with men engaged in most other fields of science have need for cooperation. The new journal should provide the means for attaining the cooperation so essential. More than this, as its pages are open to men engaged in all fields of ecology, it should become a fruitful medium for enlarging the point of view and broadening the vision of specialists in every field.

The *Journal* should be read by every student engaged in research in every science which deals with the biological environmental factors.

The editorial board is composed of fifteen scientists for the most part engaged in ecological, physiological, and forestry research. The business management of the *Journal* is in the hands of Dr. Gager and it is published quarterly by the Brooklyn Botanical Garden.

The table of contents of the first number is as follows:

Foreword.

The Scope of Ecology.....	Barrington Moore
The Control of Pneumonia and Influenza by the Weather.....	Ellsworth Huntington
Evidence of Climatic Effects in the Annual Rings of Trees.....	A. E. Douglas
Possible Effect of Seasonal and Laboratory Conditions on the Behavior of the Copepod <i>Acartia tonsa</i> , and the Bearing of this on the Question of Diurnal Migration.....	Calvin O. Esterly
A Note on the Ecology of Herons.....	W. E. Praeger

Plant Distribution around Salt Marshes in Relation to Soil Acidity.

Edgar T. Wherry

The Establishment of a Douglas Fir Forest.....J. V. Hofmann

Notes and Comments.

Proceedings.

The second number, which is just from the press, includes articles on:

Plants and Animals of Mount Marcy.....Charles C. Adams and others

Influence of Temperature and Concentration on the Toxicity of Salts to

Fishes.....Edwin B. Powers

The Effect of Two Soil Temperatures on the Yield and Water Relations

of Healthy and Diseased Bean Plants.....W. H. Burkholder

Anatomical Reduction in Some Alpine Plants.....C. C. Forsaith

Notes and Comments.

A study of forest types in the San Francisco Mountains of Arizona will appear in the third and fourth numbers.

The above list of articles is an index of the breadth of the field covered by the new journal. The fact that the editor-in-charge is a forester by training and that other members of the editorial board are engaged in forestry research argues that silvics or the foundations of silviculture will occupy an important place in its pages.

J. W. T.

The Douglas Firs; A Botanical and Silvicultural Description of the Various Species of Pseudotsuga. By Henry, Augustine, and Flood, Margaret G. Proceedings of the Royal Irish Academy, Vol. 35-B, 1920.

For many years European taxonomists, in the revision of North American genera which embrace arborescent species, have had the tendency to split certain species of wide distribution into two or more and to recognize names that the more conservative American taxonomists have long since relegated to synonymy.

Professor Henry and Miss Flood have recently published a revision of the genus *Pseudotsuga* which deals with the climatic and edaphic features of the environment of each species as well as the anatomical features which serve to separate them. Special attention is also given to the silvicultural requirements of the several species, and their usefulness for planting in Great Britain.

The authors recognize seven species and one variety; three species and one variety being American and four species Asiatic. American dendrologists have almost without exception recognized but two American species, namely, the widely distributed *Pseudotsuga Douglasii*, Carrière¹ and *Pseudotsuga macrocarpa*, Mayr, of very limited distribution.

In this revision the authors recognize *Pseudotsuga glauca*, Mayr, as a valid species and *Pseudotsuga Douglasii*, var. *cæsia*, Schwerin, as a valid variety. The Pacific coast tree, the green Douglas, is considered quite distinct from the Colorado tree, the blue Douglas, and the tree of the Northern Rocky Mountain region, recognized as a valid variety, is considered intermediate between the green and the blue Douglas. The green and blue trees are so distinct the authors believe the elevation of the blue variety to specific rank is clearly warranted. They state, "The cones of the two species have a very different appearance, those of the Colorado Douglas being smaller, with fewer scales and bracts that bend backward about the middle. The leaves of the Colorado form are much thicker. When the shoots are rubbed the Pacific coast Douglas emits a pleasant smell of pineapple, while the odor of *P. glauca* is strong and like turpentine. This is considered a more reliable means of field identification than differences in color as the blue color of the Colorado Douglas cannot be relied upon. Among other minor points of difference the more ascending branching of *P. glauca* is mentioned.

From the forester's point of view, the distinctions in the two species lies primarily in their rate of growth both in height and diameter and in their difference in climatic requirements particularly in frost resistance. The authors state that the Pacific coast tree puts on an annual height increment of two feet a year and that there are few other species which have this faculty for fast growth extending over a long period of years. Although in England it grows best on fresh, loamy, well-drained soils, it thrives much better on poor soils than generally supposed, and is now considered the best exotic conifer for general purposes, of artificial regeneration available for use in Great Britain.

¹ *Pseudotsuga Douglasii*, Carrière, the first name of the species under the correct genus is the name generally used by foresters and botanists abroad. *Pseudotsuga taxifolia*, Britton, founded on the earliest specific name is generally used in this country and is in accord with the Vienna Rules of Nomenclature. *Pseudotsuga mucronata*, Sudworth, has been accepted by some American dendrologists as the correct binomial for this species.

The authors state that the employment of this tree will render profitable the afforestation of large tracts of poor health land in England which would only yield a slight return if planted with any other species or if placed under cultivation for agricultural purposes. Plantations of this tree at Westwick, England, 20 years old, are exceedingly thrifty and 40 feet high.

The juvenile height growth of the Colorado tree in Great Britain is about one-half that of the Pacific coast tree. It is asserted that in America the former seldom attains a greater height than 80 to 90 feet while the latter may exceed 300 feet, and the inference is drawn that the variation in height in England in the two trees as shown in their early life, will continue until their principal height growth is attained. The total volume of the Pacific coast tree in a given length of time is given as roughly eight times that of the Colorado tree. In England the latter is said to be practically immune from attack by a species of *Chermes* which is now spreading to an alarming extent on the former.

The variety of Douglas fir, *Pseudotsuga Douglasii*, var. *casia*, Schwerin, was first described in 1907 and attains a height of 100 to 150 feet. The type material was collected in the interior of British Columbia where the climate is cold and dry. Its range extends into north-eastern Washington, northern Idaho and northwestern Montana in the United States. It is slow growing like the Colorado tree. Manna is said to occur on the foliage and branches of this variety of the Douglas fir in the dry belt of British Columbia. Trees of this variety have been raised in German nurseries, and have been planted both in Germany and England and are able to weather more severe climatic conditions than the typical form of this species.

Pseudotsuga macrocarpa, Mayr, as well as the four Asiatic species are of limited distribution and of minor economic importance. The Asiatic species of which one is Japanese, two Chinese and one Formosan, appear to be well differentiated although it is probable that the Formosan species *P. Wilsoniana*, Hayata, is identical with *P. sinensis*, Dode, of northeast Yunnan, China. The other Chinese species, *P. Forrestii*, Craib., has longer and larger leaves and although little known merits introduction into this country for decorative use. It has been introduced into cultivation at Edinburgh, Scotland.

The Japanese species, *P. japonica*, Boissner, is a small, relatively unimportant rare tree, and has not to the reviewer's knowledge been

introduced into this country. A few trees of this species are now grown in England.

American foresters will be particularly interested in the contrast drawn at considerable length between the Pacific coast and the Colorado Douglas firs. The trees are contrasted in habit, summer shoot, foliage, flowers, cones, wood, reproduction, resistance to frost, insect attack, rate of growth, volume and yield of timber and silviculture.

An important part of the paper is a detailed study of the microscopical structure of the leaves of the several species and the study of the oil distilled therefrom. Three plates of drawings and photographic reproductions accompany the paper.

Although the reviewer is not in sympathy with the present tendency on the part of many taxonomists to split present well recognized, widely distributed species into two or more he can see some merit in considering the Pacific coast Douglas as specifically distinct from the Colorado tree. He believes, however, that these two widely different forms, as well as the variety *cæsia*, show all grades of intermediates. He has observed these trees in the field in many different localities and is convinced that thousands of trees exist which cannot be satisfactorily relegated to one or the other of the two species of Douglas recognized in this paper or to the variety. He is wondering if it is not best to consider them all a single widely distributed species of many forms.

J. W. T.

PERIODICAL LITERATURE

SILVICULTURE, PROTECTION, AND EXTENSION

Forestry Much has been written from time to time in
and this country regarding the advisability of estab-
Farming lishing fully stocked stands of timber on aban-
 doned farm lands and on idle fields that are a
 part of operated farms. It is conceded by all

that the farmer must to a constantly increasing degree give well directed and conscious care to the non-agricultural parts of his farm.

Throughout many parts of New England as well as elsewhere many abandoned farm lands have come in to acceptable stands of timber and plantations have been made in constantly increasing numbers in recent years. Acceptable natural stands, however, have more often been the result of accident than conscious care and plantations on abandoned fields have been only too often delayed until volunteer growth of worthless material has made effective planting far more expensive than necessary. The sooner the plantation is established after the field has been abandoned for agricultural purposes the better growth the plantation makes, the smaller the loss of stock from the planting operation and the longer cleanings can be delayed in the young stand.

In the change of land from agricultural land use to forest it is decidedly advantageous to plan the work some time before the transfer is actually made.

In the article under review emphasis is placed on the nature and kinds of agricultural crops immediately preceding the transfer and the possibility of an agricultural crop accompanying the first year's growth of the stand of timber. The writer states that "forestry by precultures" is the most remarkable innovation in modern forestry in England and has been attended with such striking success it is being widely adopted. It is most effective on poor land and is based on the improvement of the soil through cultivation to such an extent that it becomes suited to the varieties of trees which have been selected for planting. When an area of poor land that has been idle for some time is taken in hand and brought into acceptable condition through cultivation and the use of fertilizers the improvement is followed by agricultural crops

which sometimes have a profit but more often pay for the expenses incurred or at least reduce them to such an extent that afforestation is made under greatly improved conditions at low cost.

When agriculture and forestry share between them the area of the estate, the parts are assigned to forestry that are not suited for permanent cropping. The aim of "preculture" is to destroy the natural vegetation covering the land, which instead of being a hindrance, is turned to good account by adding to the humus; to break up and aerate the soil and insure drainage; to ameliorate the soil and add to its available mineral nutrients; to improve the physical condition by increasing its power to hold water; to enrich it with available nitrogen and add to its bacterial flora; to make the agricultural crop which follows the culture pay for the expenses; and to provide an acceptable soil in which to plant trees at a minimum of expense and with a maximum percentage of growth.

Moreover as the planting site is clear, direct seeding often can be employed.

In the reviewer's opinion many poor lands in New England that have been long abandoned for agriculture might advantageously be brought under forest crops by "precultures." Where the soil is hard, compact, and covered with a dense growth of perennial herbage were it broken up and cultivated, the agricultural crops might go a long way in paying for the cost and the forest plantation could be made later at half the cost and with far greater assurance of success.

J. W. T.

Vendelmans, Henry. *Forestry by Precultures*, Quarterly Journal of Forestry, Vol. XIX, No. 3, pp. 185-190, July, 1920.

*Technique
of Natural
Reproduction*

Eberhard describes the development of a silvicultural systems, beginning with the primitive irregular selection cutting. Hundeshagen developed the shelterwood system (Dunkelschlagbetrieb) with preliminary seed cuttings, later cuttings to give light for the seedlings, and final removal cuttings after the reproduction is well established and able to thrive in the open. Natural reproduction was relied on almost entirely as cheaper and more satisfactory than artificial restocking. After Hundeshagen, silviculturists gradually got away from the idea of natural restocking, and adopted clear cutting with planting. Gayer and H. Mayer de-

scribed methods similar to Hundeshagen, except that they provided for less frequent but much heavier early fellings, which resulted in less satisfactory reproduction and in more loss from windfall. Borggreve's method was more like Hundeshagen's, but delayed the later cuttings longer. Gayer described a group selection cutting (*Femelschlagbetrieb*) in some respects similar to the shelterwood system, but much less satisfactory. Engler advised a combination of group selection and shelterwood, especially for mixed stands containing tolerant and less tolerant species. Gayer also developed a strip shelterwood system, resulting in a stand with regular age gradations in parallel strips. Wagner's selection strip or selection border cutting (*Blendensaumschlag*) provides for reproduction of tolerant species under the stand by making thinnings or selection cuttings, then clearing strips so that the intolerant species can reproduce. Mayr described a system which he considered applicable to most of the irregular many-specied forests of the world, including those of the tropics. He provided for reproducing a tolerant understory at about the middle of the rotation, followed by occasional thinnings of the overstory to prevent natural losses, and fairly heavy seed cuttings at the end of the rotation, just before or just after the seed falls. The old stand is then to be removed in one or two fellings, within 5 or 6 years. Kubelka, in his selection strip system (*Femelstreifenbetrieb*) gets reproduction by opening holes in alternate strips, and gradually enlarging them. Kalitsch's *Bärenthorn* system and the author's wedge shelterwood system (formerly called *Abrücksaufschlag*, more recently *Schirmkeilschlag*), are very similar in providing for very frequent—annual if possible—cuttings throughout the stand, which do not break the canopy. The last method is particularly distinguished by the form of removal cuttings, which are developed in wedge form, beginning in the middle of the stand so that logging will not injure established reproduction. In the author's opinion, present German silvicultural practice (which has also been carried to Russia by foresters trained in German schools) is far behind that at the beginning of the 19th century. The prevailing forest form has gone during the last 200 years from a straight selection forest to extensive pure even-aged forests produced artificially. It is now returning gradually to a modified selection form, very much more intensively cultivated than formerly, with mixed stands and natural reproduction. W. N. S.

Eberhard, Julius. *Die Technik der Naturverjüngung einst und jetzt. Eine forstgeschichtliche Studie.* Forstwiss. Centralbl. 42: 161-183, 204-226. 1920.

*Vegetation
as Affected
by Wind*

Bernbeck discusses the adaptation of vegetation to wind and the effects of wind on vegetation, with especial reference to forest growth. Adaptation is to enable the plant to withstand the physical impact of wind, or to prevent excessive evaporation from the plant tissues or both. Wind firmness is not an inherent characteristic of any given species, although the tendency toward windfirmness may be inherited; thus a fir grown in the open may be much more windfirm than an oak grown in a dense stand protected from wind. Under the right conditions any tree can develop a windfirm form. This fact can be utilized in silvicultural management, so as to minimize loss from windfall. (35,000,000 cubic metres of timber, principally coniferous, was blown down in Germany during the last century.) Wind climate often governs the geographical distribution of trees. For instance, conifers are most liable to injury during the winter months, so sites exposed to continuous winter storms (if fertile enough to allow tall tree growth) are usually occupied by hardwoods, while mountain slopes and plateaus where heavy early summer winds prevail are occupied by conifers. Wind affects the growth and form of trees not only indirectly, by its influence on such site-factors as soil moisture, transpiration, temperature, and exposure of foliage to the light, but also directly, by its physical effect on the plant tissues. Internal stresses and friction between the fibres result in eccentric growth, and also help to stunt the tree by interrupting sap-flow and through their effect on cell structure and turgescence. Investigations made at Bonn showed clearly that the stunting effect of wind increases rapidly with wind velocity.

W. N. S.

Bernbeck. *Das Wachstum im Winde*. Forstwiss. Centralbl. 42:27-40, 59-69, 93-100, 1920.

*Smoke Injury
and
Soil Science*

There is a close relation between soil composition and quality and the damage which may result to vegetation from various fumes and dusts. Most smoke damage is done indirectly, through effect of the chemicals on the soil and humus.

Lime is especially necessary in soils exposed to acid fumes, and should be added in the cheapest way possible where soils are poor in lime, otherwise the acids will remove all the lime present. This applies both to open and to forest lands. It has been computed that in the vicinity of Sottberg (Rhine province) approximately 800 grams of

sulphuric and hydrochloric acids are deposited annually per square meter of soil. Lime also combines with poisonous zinc, copper, iron, and mercury salts and renders them harmless to plants, but has little or no effect on arsenic compounds. Some of these compounds in small quantities stimulate plant growth, but in large quantities hinder or destroy it. Dust from lime, cement, or magnesite ovens, etc., may act as a fertilizer, or if in too great volume and not occasionally harrowed into the soil may form a crust which will injure vegetation. Soot does not in itself injure plants, but does so indirectly by sticking on the foliage and adsorbing other poisonous gases from the air. In case of many substances, such as calcium, magnesium, chlorine, fluorine and sulphur compounds, which are already present in soil not exposed to smoke, it is difficult to determine the amount of injury due to fumes, since chemical analysis of the plants will not show the origin of the poisons they may contain. W. N. S.

(Graf zu) Leningen-Westerburg. *Rauchschäden und einschlägige bodenkundliche Fragen*. Forstwiss. Centralbl. 42: 18-93, 1920.

Fabricius describes the silvicultural system

New Form of Shelter-wood Cutting used by Dr. Eberhard in the Langenbrand forest (Württemberg). This consists of a preparatory stage, in which the stand is prepared for reproduction by repeated moderate thinnings and a stage of removal cuttings beginning about 5 years after reproduction is established. The preparatory cuttings are primarily to get rid of raw humus, which may also be removed by hand either over the whole area or in seedspots. These cuttings also make room for reproduction, especially of tolerant species, to start. The removal cuttings are rather light, and repeated every year if practicable. They begin in the interior of the stand and progress outward, beginning with small openings, which are gradually enlarged into a wedge shape with the point toward the wind. The shape of opening is not definite, but may be varied to suit local conditions. Damage from storms and logging is reduced to a minimum, and natural reproduction is very successful. Of the whole area, 92 per cent has been reproduced naturally. The principal characteristic which distinguishes this from certain other methods is the shape and arrangement of the cuttings so as to eliminate damage from logging and from winds. W. N. S.

Fabricius, L. *Waldbau-Lehrgang im Gebiet des Langenbrander Schirmkeilschlages*. Forstwiss. Centralbl. 42: 233-237, 1920.

SOIL, WATER, AND CLIMATE

*Summary of
Bavarian
Soil Conditions*

Niklas discusses the construction of a general soil map for the country, based on the prevailing crops grown in each district, which he states is a fairly reliable basis since agricultural practice through centuries has tended to select the crops best adapted to the different soils. The same is more or less true of forest crops. Complete soil surveys are lacking and can not be made in a reasonably short time. He states that census figures on crop yields are extremely inaccurate, but that data on crop areas are quite accurate. Soils may be classified according to climatic conditions, according to geological origin, or according to texture. For practical purposes the latter classification is the best, both for agriculture and for forestry. The 434 districts of Bavaria are classified in 7 groups, according to whether the predominating soils are (1) very heavy (wheat, meadow, no barley—13 per cent of the total area of Bavaria); (2) heavy (wheat, barley—12 per cent); (3) medium (optimum barley—14 per cent); (4) heavy and light about equal (all kinds of crops); and (5) light and medium (oats, rye, some barley)—together 17 per cent; (6) light (rye, oats—31 per cent); (7) meadow soils due to climatic conditions regardless of texture, 13 per cent. Among the uses for such a map are enumerated: a basis for land settlement policy; shows regions adapted for certain crops; useful in organizing farm work and the furnishing of seed, labor, machinery, and teams; helpful in studying occurrence and spread of animal and plant pests, in studying relations between climate and soils, and between social and economic conditions and soils.

W. N. S.

Niklas, H. *Übersicht über Bayerns Bodenverhältnisse*. Forstwiss. Centralbl. 42: 123-135. 1920.

*Vegetation as
Forest Site
Indicators*

Rubner discusses Cajander's theory that forest sites can be classed into a very few types, based on key plants, such as *Oxalis*, *Vaccinium myrtillus* and *Calluna*, regardless of elevation, soil conditions, latitude, or other factors, and that the growth of the same species within one type wherever located is about the same, but is very different in different types. Rubner does not believe that such general classification, even with the subtypes Cajan-

der proposed, can be made to apply to a large region, but that each locality will have certain plants that indicate the character of the different sites, which may or may not be common to other localities. He illustrates by discussing the vegetation under the forests in the districts of Betzigau, Ottobeuren, Sachsenried, and Denklingen, which is the optimum spruce region in Bavaria and possibly in all Germany, with yields far above the average for Quality I. sites. Indicator plants show particularly the humus conditions, *i. e.*, whether the soils are mild, with normal decomposition of humus, or whether they are becoming acid with raw humus. Such plants may be *guide-plants*, practically always found on a particular kind of soil; *accessory indicators*, frequently present but often missing; and *regional indicators*, found only in certain regions. Plants indicative of mild soils are *Oxalis acetosella*, *Asperula odorata*, *Impatiens noli-me-tangere*, *Galium rotundifolium*, *Elymus europaeus*, *Milium effusum*, *Brachypodium silvaticum*, *Carex silvatica*, *Catharinea undulata*, *Mnium undulatum*, *Hypnum* spp. Indicators of beginning or continuing raw humus formation are: *Vaccinium myrtillus*, *Festuca silvatica*, *Lycopodium annotinum*, *Polytrichum formosum*, *Dicranum scoparium*. This matter deserves much more attention from forest investigators, since it has a very direct bearing upon silvicultural practice, especially in connection with natural reproduction and with methods of thinning.

W. N. S.

Rubner, K. *Forstliche Standortsgewächse im westlichen Moränengebiet Bayerns*. Forstwiss. Centralbl. 42: 135-144, 1920.

MENSURATION, FINANCE, AND MANAGEMENT

S. H. Howard proposes to apply Von Mantel's *Formula for Selection Forests* to selection forests as the basis for determining the cut. Shorn of all more complicated discussions and formulæ, the proposed formula,

Annual cut = $\frac{V}{\frac{3}{8}R}$, is identical with that of Von Mantel, Annual cut = $\frac{V}{\frac{1}{2}R}$, except that the volume in the new formula is that for the last half of the rotation instead of for the entire rotation.

The erroneous but practical assumption underlying Von Mantel's formula, that mean annual growth equals current annual growth in each year, hence that the volume of a series of age classes is repre-

sented by a triangle, permits of assuming that the volume of the age classes composing the last half of the total series is three-fourths of the total.

Then if V = volume in last $\frac{1}{2} R$ series, and I = annual increment, which equals annual cut desired, or Y , then $V = \frac{3}{4} \left(\frac{I \times R}{2} \right) = \frac{3}{8} I \times R$.

Since $Y = I$, $Y = \frac{V}{\frac{3}{8} R}$.

In applying this formula to selection forests, the girth which is equivalent to the age of an average tree of $\frac{1}{2} R$ years is taken as the limit of size for enumeration of growing stock. The growth data required are, the age required for the rotation, and the average age of trees of different girths.

The author claims that this formula, which can be applied universally, is superior to existing methods of determining the rate of growth of girth classes, the number of trees which will mature in a given period, and the attempt to predict loss of numbers and possibility on the basis of numbers.

The weakness in this method is its assumption of normality for the younger age classes. The French Method of 1883, which has been successfully applied to selection forests, is based on the principle proposed in this formula, except that $\frac{1}{3} R$ is the period adopted, and the crop is enumerated for $\frac{2}{3} R$ or two periods, which permits of a comparison to determine whether the older age class is deficient or has a surplus. By this plan the normal proportion is $\frac{3}{9}$ to $\frac{5}{9}$ leaving $\frac{1}{9}$ to represent the first $\frac{1}{3} R$ in the triangle.

Then the exploitable volume of the last $\frac{1}{3} R$ is $V = \frac{5}{9} \left(\frac{I \times R}{2} \right) = \frac{5}{18} (I \times R)$, and $Y = \frac{V}{\frac{5}{18} R}$

Comparing Von Mantel's formula with these adaptations we have

$$\text{Von Mantel} \quad Y = \frac{V}{\frac{1}{2} R} = \frac{V}{.5 R} \quad V = \quad V$$

$$\text{Indian method} \quad Y = \frac{V_1}{\frac{3}{8} R} = \frac{V_1}{.375 R} \quad V_1 = \frac{3}{4} V$$

$$\text{French method} \quad Y = \frac{V_2}{\frac{5}{18} R} = \frac{V_2}{.278 R} \quad V_2 = \frac{5}{9} V$$

As a short cut to the solution of the problem of increment and regulation of selection forests in India it is probable that the proposed adaptation of Von Mantel's formula may prove distinctly useful.

H. H. C.

Indian Forester, Vol. 46, pp. 417-421, August 1, 1920.

STATISTICS AND HISTORY

By the Versailles treaty Prussia lost definitely
Some Problems 581,513 hectares of forest with an income of
of the Prussian 23,459,000 marks, besides a possible loss of 346,-
Forest Service 862 hectares and income of 24,519,858 marks in

the plebiscite areas, and 34,958 hectares and 2,208,000 marks in the districts of Aachen and Trier. Although wood prices have risen along with all other prices the Forest Service must try to keep them down within reason. It is proposed to cut one-third more wood than usual to supply fuel needs, especially of the bakers, but in many places increased production of fuelwood will have to be at the expense of construction timber or mine timbers. Receipts from turpentine brought in a considerable revenue, but can be counted on only so long as the industry is needed to supply domestic requirements and is profitable. A demand has arisen for more agricultural land, with the tendency to demand clearing of parts of the State forests. There is also considerable deforestation of private forests, so that a law is under consideration giving the government authority to regulate such clearing and requiring that all forests of more than 15 hectares be subject to State supervision. The question of salaries and allowances is very pressing, as illustrated by the allowance granted Oberförster for maintenance of teams—3,000 marks in 1917 and 6,000 marks in 1918, while the actual cost of keeping a team is now 9,000 marks per year. In connection with the salary question it was stated that between October 1, 1918, and October 1, 1919, forest vandals killed 13 forest officers and wounded 3 others.

W. N. S.

Anonymous. *Die Verhandlungen der Preussischen Landesversammlung über den Staatshaushaltsplan der Forstverwaltung*. Forstwiss. Centralbl. 42: 106-114. 1920.

Rubner discusses prices of wood (chiefly fire-
Early Wood wood) in various localities, going as far back as
Prices in 1630 in some instances. Especially noteworthy
Germany is a rapid increase in prices about the middle of
the 19th century, which was attributed by some

to increased population, rise of wood-using industries, and decreased wood production, and by others to an era of speculation. Just as relief came then through the development of railroads and the rise of a world trade in wood, so can relief from present abnormal wood prices, which are also due to a considerable degree to speculation coupled with inadequate supplies, come only with the resumption of imports from Russia or other exporting countries.

W. N. S.

Rubner, K. *Holzpreise in Süddeutschland in früherer Zeit*. Forstwiss. Centralbl. 42: 226-233, 1920.

NOTES

ANTON VON BÜHLER

With Professor Anton von Bühler, who died on January 1, 1920, there passed one of the last of the great leaders of the German forestry profession during the past three decades. Born in 1848, in Württemberg, the son of a forester, he was educated at the Forest Academy, Hohenheim, and University of Tübingen. After several years as assistant at the Hohenheim Forest Experiment Station and three years in charge of a forest unit, in 1882 he became Professor of Forestry at the Polytechnicum in Zürich, where he took the lead in building up Swiss forest research. In 1896 he was called to Tübingen, where he remained in active duty until 1919, teaching silviculture, forest utilization, forest policy, and forest history, and since 1902 in charge of forest research. His great contribution was to forest research, and he has even been called the founder of this branch of the profession. His work culminated in the well-known treatise "Waldbau" (Silviculture) which is a standard work on the subject. "His peculiar acquaintance with forest literature, even to the earliest times, convinced him that there is scarcely a theory which has not been advanced already, scarcely a method which has not already been applied."

BROADCASTING SLASH PINE SEED

Good results are reported from experiments in broadcasting slash pine seed, conducted by the Forest Service in co-operation with the State Agricultural College near Summerville, S. C. A series of 18 small-sized sample plots was sown in the fall of 1917 and a duplicate series in the following spring. These included a wide variety of conditions in regard to soil, moisture, ground cover, and methods of sowing.

The most interesting results are the very satisfactory stands of young trees obtained from broadcasting seed in heavy grass. At the end of two years the fall sowings have given 6,534 seedlings per acre, with no treatment after broadcasting, and 20,909 seedlings per acre where the grass was harrowed following the sowing. The seed was sown

at the rate of 5 pounds per acre. On the basis of these experiments, satisfactory stands of slash pine may be expected from broadcasting on grass without further treatment at the rate of 1 to 2 pounds per acre in the fall and 2 to 3 pounds in the spring. Operations on soil prepared by plowing and harrowing gave the best stands, with 43,442 seedlings per acre, from 1 to 3 feet high, resulting from the fall sowing, and 11,435 seedlings per acre from the spring sowing. Obviously this method is too expensive to be practiced on a large scale. Seed-spot sowing gave results varying from 7 to 72 per cent of the spots with seedlings at the end of the second season. Here fall sowing averaged again noticeably better than those made in the spring. The results are of interest because of their favorable character and the possibility of applying them on millions of acres of practically idle cut-over lands in the South Atlantic and Gulf States. The species grows rapidly and at an early age produces good financial returns in turpentine and timber. This tree of high commercial value occurs extensively, where fires have been excluded or limited in occurrence, on the poorly drained flat lands of the coastal plain from South Carolina west to the Mississippi River.

SOCIETY AFFAIRS

KELLOGG PROTESTS

The referendum on the report of the Committee for the Application of Forestry seems to have left matters very much up in the air notwithstanding a widely distributed statement by an eminent authority to the effect that the Society "voted three to two in favor of national control."

An analysis of the statement of the Canvassing Committee published in the October JOURNAL, compared with the membership roll of the Society, yields the following results:

Society members entitled to vote		Voting on Clause Number 7				Total vote	
Class	Number	Yes	Per cent of membership	No.	Per cent of membership	Number	Per cent of membership
Fellows	6	3	50	1	17	4	67
Senior members.	356	81	23	54	15	135	38
Members....	58	10	17	6	10	16	28
Total....	410	94	23	61	15	155	38

This shows that but 23 per cent of the total voting membership of the Society voted "yes" on Clause No. 7; that 15 per cent voted "no" and that for a wide variety of reasons, some of which are stated by the Canvassing Committee, 62 per cent of the Society membership either failed to vote on the proposal as submitted, or their votes were not counted.

The Canvassing Committee reports that only 21 unqualified affirmative votes were cast in the referendum. It would appear therefore that but 13 per cent of the 166 voting members gave straight affirmative ballots. Moreover, the members so voting represented but 5 per cent of the voting membership of the Society, and the others who voted in the referendum accompanied their ballots by qualifications, explanations, and interpretations, upon which the Canvassing Committee was obliged to place its own construction, in order to determine whether the votes should be put in the "yes" or "no" column.

To sum up the whole matter, it is evident that a very small minority of the Society of American Foresters has declared in favor of direct national control of the lumber industry.

R. S. KELLOGG.

OLMSTED REPLIES

The light vote of the Society was referred to in an editorial on page 658 of the October JOURNAL, in which it was mentioned that former votes of the Society had always been light, averaging between 40 and 50 per cent of the total membership. Mr. Kellogg shows that the vote on Clause No. 7, relating to national control, represented 38 per cent of the total membership.

It might be stated also that the vote was obtained in spite of a lively campaign in several of the Sections carried on for the purpose of persuading members not to vote.

As for the 21 straight affirmative ballots, it was a decided surprise to the Committee for the Application of Forestry that 21 men thought best to approve the report as a whole. Several members of the Committee did not do so.

A President of the Society is none the less President because he is elected by a minority of the total membership (39 per cent in 1918, 41 per cent in 1919). The vote on Clause No. 7 expressed the opinion of the Society on the question of national control so far as the ballot was able to bring it out. Have we any better indication of the feeling in this respect? The statement that the Society "voted three to two in favor of national control" is merely a statement of fact.

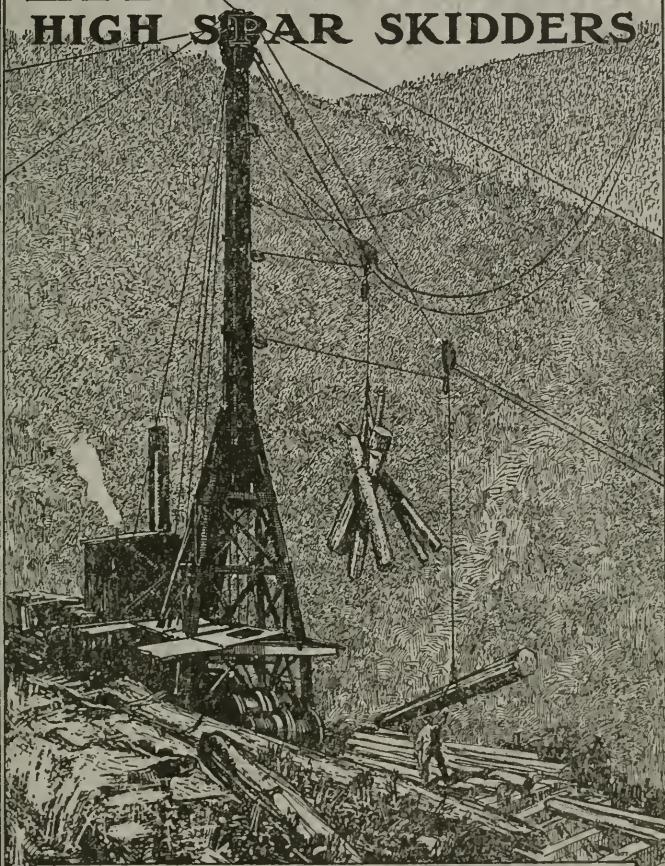
F. E. OLSTED.

PRELIMINARY ANNOUNCEMENT OF THE NEW YORK MEETING

The twenty-first annual meeting of the Society of American Foresters, under the direction of the President, Prof. R. C. Bryant, will be held in New York City on Monday, December 20, 1920, at the Yale Club. The morning session will open at 9.30 and close at 1 o'clock. The afternoon session will run from 2.30 to 5.30. In the evening there will probably be arranged a Round Table conference either in the form of a dinner or smoker. The program will consist of the annual reports of the officers of the Society, announcement of the vote, other business matters, and the presentation of papers. The members of the Society were invited, through the Secretaries of their Sections, to submit titles of the papers to be read at the annual meeting. Titles of papers, together with a statement of the time needed for their presentation, should be submitted to any member of the Committee on Arrangements—Paul D. Kelleter, Forest Service, Washington, D. C.; R. C. Hawley, Yale Forest School, New Haven, Conn.; or J. S. Illick, Department of Forestry, Harrisburg, Pa. The titles must be received by December 1 to enable the printing and mailing of the final program.

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No. 8

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The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

A NATIONAL GAME POLICY¹

BY SMITH RILEY

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There is a distinct awakening or new movement, which starting well before the war developed rapidly through its period, and has unlimited possibilities for the future. In this I mean the control of business in the public interest. An example here would be the working of the Interstate Commerce Commission. A better example would be the labor laws limiting the hours of work and fixing sanitation requirements. All with the greatest results in building human qualities.

In the establishment of the juvenile and social welfare courts there is the well-established purpose not to condemn or punish crime growing out of bad conditions but to find and remove the cause by creating surroundings unfavorable to its culture.

The main result here, though the purpose may be otherwise, is the building of human qualities stabilizing and therefore beneficial to industry.

The recent draft law taught us a great deal about the importance of proper living conditions. It brought a partial inventory of the human resources of the country; and it was found that about 30 per cent of the young men of the country between the ages of 31 and 21, when they should have been at their best, were unfit for strenuous military service. Of these the major part were unfit because of social conditions. I do not mean by this to say that they were products of the slums, and while there is no exact data on the subject, observations by a member of an exemption board leads him to the belief that if this 30 per cent of unfit had been brought up in the proper surroundings,

¹ Delivered before the Washington Section of the Society of American Foresters, October 19, 1920.

with wise parents to guide their development, very few would have failed to pass the most rigid tests. In other words, their defects had been caused by their surroundings or conditions of life.

Now the effect upon the industry of the nation of this high percentage of subnormal lives is bad—distinctly bad, judged by even the most cold-blooded, calculating material standards. For the industrial product of these people is necessarily inferior. Capital is learning this, and a very serious effort is now being made to improve the quality of labor and reduce the turnover. Better working conditions are the order of the day. Progressive employers are voluntarily offering more favorable conditions to their employees. They are themselves recognizing the wisdom of framing their contracts in the social interest. A few years ago one never heard of a playground for the employees of an industrial plant. Today, as one rides from the suburbs into the larger cities through manufacturing districts, playgrounds are to be seen that have been outfitted by the factories. Some of them operate schools and gymnasiums as well.

We must realize that business is not concerned merely with property and contract, but deals in human values, and that its welfare and that of the community are indissolubly bound together. There is need of greatly advancing means and methods for the development of the human factor. It is unnecessary to emphasize the importance of this to the State and Nation.

The foremost purpose, the greatest asset in the creating of park or forest might well be the use of such areas in the building of human values. The preservation of the soil, water, timber, or forage, go for naught without we first have the human factor in which the high features are paramount.

America as a Nation is commercial and yet the human values must stand above property to perfect this commercialism. The foundation of life is to preserve given standards. From this basis there is every argument for national activities looking always to this end.

In the Life of Henry Adams there is the following statement:

“Winter and summer then, were two hostile lives, and bred two separate natures. Winter was always the effort to live; summer was tropical license. Whether the children rolled in the grass, or waded in the brook, or swam in the salt ocean, or sailed in the bay, or fished for smelts in the creeks, or netted the minnows in the salt marshes, or took to the pine woods and the granite quarries, or chased muskrats and hunted snapping turtles in the swamps, or mushrooms or nuts on

the autumn hills, summer and the country were always sensual living, while winter was always compulsory learning. Summer was the multiplicity of nature; winter was school."

Here, there is a definite expression of the old order of things. Education was work in winter. Summer was for sensual life of no educational value. Today work is play and play is work, with a growing realization that the greatest progress in educational fields is made through play.

A National Park is created to preserve natural phenomena of national importance so its curiosities may be perpetuated for the pleasure of the people. How much stronger would be the argument for this park with its purpose to serve as a culture area for human betterment and not merely to protect natural beauties?

A National Forest is created to preserve the resources of the lands embraced. Complete use of these resources by the public is encouraged and every effort is put forth to develop the lands in the interest of industry. In some cases the demand for use is so intense that preservation of original values is possible only with constant diligence. While the preservation of the forest resources as a national asset is important, how much greater purpose they can be made to serve for building human qualities, both mental and physical. We are inclined to define recreation for pleasure and enjoyment, failing to weigh the development from such activities which extend over a wide field. The ever-changing prospectus as one proceeds through the forest, the form and grouping of the tree trunks, the variety and intricate detail of the topography and undergrowth of woodland shrub and young trees, and the delicate forms and infinite variety of the ferns, mosses, creeping vines, in fact, every phase of vegetable and animal life calls forth observation and response from human nature with ever-increasing benefits.

There may have been a time, centuries ago, when the study of nature was limited to the study of uncanny things, and practiced so that it marked the individual who dealt with the subject as an oddity set apart from his fellows. But nature study, like everything else, has been permeated by the spirit of the modern, utilitarian age until, from things of perhaps of little importance, if limited to miserly collecting, it has come to be a most important factor in modern training. Think how big a part of the child's time the so-called nature study now takes up in school. It is used not only to fix a knowledge of the land in which the child lives, but there is no known factor of education that

has the power to quicken a sense of interest like the subject of natural life.

Every parcel of land suitable should produce its quota of wild life in the national interest. Those who question this policy have but to analyze the possibilities in its use, both direct and indirect. There are many men who feel the benefits from the association in the game fields, the fishing waters or the natural history areas of the country.

The boy who has received a lesson in fair play by being punished for shooting quail on the ground will never forget it. Those parents who have taken a delicate child into the open and stimulated a healthy development of mind and body by arousing an interest in the birds and animals of the region, may not fully appreciate the value of the wild life, though they are grateful to God for the development of their child. I know a father who is particularly proud of the fact that his small boy has, through an interest created by the parent while upon walks in the parks and the open grounds around town, developed the power of observation in identifying the tracks of birds and animals. There was a child whose parents were at a loss to develop its character and overcome the weakness of timidity. An opportunity offered to interest the child in the life habits of several chipmunks at a mountain camp. The lesson taught here was that these little animals, so much smaller than the child and thrown on their own resources, existed in bright happy lives protected by Divine providence.

I want to emphasize the point that association with the life in the open tends to develop those finer sensibilities together with the traits of character with which they are associated. That child or adult who has learned to understand nature's laws will face life with an acuteness of understanding and a quickness of sympathy, in fact, a bigness of soul that nothing else will develop.

In Rockwell Kent's book, "Wilderness," there is the following statement:

"I think that while cruelty appears upmost where boys herd together, the love of animals is no less characteristic of many sensitive children. But this I am certain, that nothing will make a child more ridiculous in the eyes of a mob child than this most perfect and most beautiful attitude of some children towards life. In considering the education of a child and weighing what is gained or lost by one system or another, I am inclined to think that no gain can outweigh the loss to the child of this loving non-predatory impulse.

"I do not know how such haphazard education, if continued, would fit him for participation in the 'practical' affairs of life, but I am convinced that if all the little beauties of spirit that can now be seen budding could be allowed free, clean growth quite away from the brutal hand of mass influence, we'd have nothing less than the full and perfect flowering of a human soul: and in our reaching towards supermanhood none can do more.

"Rockwell went for a walk in the woods; he has a delightful time on his rambles, discovering goats' wool on the bushes, following paths of the porcupines to their holes, and today, finding the porcupine himself. He always returns with some marvelous discovery or new enthusiasm over his explorations. These things are of infinite nature, and in every one of us in just proportion.

"Here is an example of his imagination that it is hard to picture as surviving in the atmosphere of a large school. Rockwell, for two or three years, has called himself the 'Mother of all things.' It is not a figure of speech with him but an attitude towards all life.

"For the wilderness is a kind of a mirror that gives back as its own all and only all that the imagination brings to it. It is that which we believe it to be. It is wonderland itself. The King's road. The giant's path where stands the 'ten-pound butter tree.'"

I have quoted the observations of Mr. Rockwell in regard to the development of his boy's character while living on an island in Alaska, as it shows so clearly the value of the open and the wild life in the development of human qualities.

There is an army officer, who in his youth had a keen appreciation developed by his surroundings and the active enthusiasm of a devoted father. This officer, in viewing the values in his life, wishes above all things, to hand on to his five children those which have been such a big asset in developing the standards of his character. The wild life as he knew it in his youth has passed forever so these children cannot have the father's experience in its fullness; so the officer has set himself the task of preserving to the utmost all the wild life which can be produced upon the reservation of the arsenal of which he is in charge. Through an acquaintance with this life he expects these children to develop a quickness of thought, a keenness of observation and perception, and an unselfish sympathy, in fact, a depth and breadth of character that will carry them far.

This officer realizes, that with these children as with himself, between the ages of 5 and 21, lasting impressions are received from a knowledge of wild life and the forest. This is the entire period that bridges over that critical time between childhood and maturity, that

begins in weakness, immaturity, and dependence, and ends in vigor, and self-reliance. It is the habit-forming period, of easy and lasting impressions, the time when the seed of good or ill may be most readily planted and will take the deepest root. It is the time when the senses are most alert, when the feelings are most easily aroused and the sensibilities are most readily appealed to, when the intellect is most susceptible of development and the will of training. It is the time when the imagination is most active and can be most readily aroused and easily cultivated.

The use that is made of this period will inevitably exert a wide influence on the industries and occupations of life, on the trades and professions. It will effect the character of the home, the appearance of the landscape. It will enter largely into the lives of the people, into the nature of their dealings, the character of their relations; yes, far more, upon it will ultimately depend the destiny of the Nation.

The forester of old administered the forest lands to produce life for the chase; today, he must administer to produce products of first importance in maintaining human values. The game, then, as a forest asset for the chase, becomes secondary, and every form of animal life, grouped as wild life, becomes important as a resource of the forest because of the extensive use to which it can be put or is now used to maintain human qualities. The wild life is a product of the forest lands. In fact, a map of the forest areas might well be used to designate the extent of the space where wild life can be produced. The forester, through his relation to the forest, must stand to the fore in directing public thought and guiding public action to fix a national wild life policy.

The Federal Government must always be in the nature of a protectorate or guiding hand to the States. In some cases it may be the extension to the States of influence and power which only the Federal Government possesses. In other cases it may be merely matters of example; but in either case must exercise a guiding influence. Therefore in the administration of the Federal lands within the States, held in trust for all the people, there is a very distinct obligation to produce a full quota of wild life, if for no other reason than to serve as an example of what constitutes forest products.

Wild life culture has its place and is of importance in the extent to which its creatures serve effectively as objects of study and inspiration. The standards of life developed by a nation of sportsmen in the

preservation and use of the creatures placed upon this earth by God gives a clear grasp of the game as a national asset.

The fact that the game is the property of the State does not lessen the need of the forester's interest or the National Government's duty to provide amply for wild life production. This interest is established through the ownership of the areas and besides this the Government owns practically all the land upon which game could be produced in those regions where the bulk of the National Forests are located.

The Nation should be vitally interested in the production of wild animals through the important value of natural history. For this reason foresters should recognize the necessity of ample provision for the game on all lands used for forest culture.

When one speaks of game there is naturally the thought of those animals and birds sought in shooting. When one speaks of wild life there is the thought of all birds and animal life found in the open, and this last is the sense in which the subject should be approached in defining its complete value.

The open is rendered doubly attractive by the presence of that life which is characteristic of it, and its bald effective use depends greatly upon the presence of this life. The issue takes shape then in a much broader sense than that of the chase. The mere presence of this life, which may be apparent in a dozen different ways even though it is not actually seen, gives a very material value in the interest which it stimulates. The actual hunting, while extensive in all its ramifications, is the smaller part of the value. Against one person who hunts there are thousands stimulated to an interest of active observation and study.

Taken upon the old order of things, there was no justification for the forester to withhold from direct industrial use, any of the forest lands. Where the values of the chase were considered with its atmosphere of pleasure or light sport, in fact, the rich man's game, there arose continuous objections to the extensive use of forest lands for game production. Doubtless some of this objection found its origin in European countries where forests are sometimes abused in the production of life for the chase and the interests of the masses are ignored in developing the interests of the classes.

This recognition of human values as a national asset resulting in the regulation of business in the public interest will control those who see only property exercise as functions of activity. It is a power for

the conservationist to reckon with. It is available to the forester in shaping a wild life policy. If it is not recognized it may become a stumbling block, a steam roller flattening all before it.

The growing public demand for game protection has resulted in action and while this has been extensive it has not been anywhere near adequate. The lack of concerted action has been the chief weakness. I must mention here the forester's persistent lassitude which takes the shape of no responsibility and is voiced in an unenergetic argument for game in the forest provided it does not interfere with anything. Certainly, in what has been accomplished so far towards preservation and culture there is little which the foresters can point out to be proud of as their work.

The whole question is in crying need of action. The time is past for petty differences over details. I want the foresters to advocate vigorously wild life culture in its higher phases of national use as a forest product important above industry.

I want the forester's active participation in public organization for wild life protection and culture through close co-operation between States and Federal officials for better State and Federal laws.

A SKETCH ON SWEDISH FORESTRY FROM AN AMERICAN STANDPOINT¹

BY H. R. WICKENDEN

Forestry practice in Sweden is in many respects of interest to us Americans because it is yet in a plastic form and is applied to forests which are not as well ordered and controlled as in Germany, or even better, in Denmark; at the same time it is very broad-minded, not so fixed and predetermined as in some lands where forestry started centuries ago. While some regulations and laws have been existent for a much longer time, the most decisive steps were first taken in the fifties of the last century and these have undergone many revisions since then, until today a fairly permanent system is in force.

FORESTS AND CLIMATE

It is unnecessary to comment on the climate and forest types as this information may be known or available to those interested. The following generalization suffices here: Scotch pine and Norway spruce are the chief commercial trees, the development of which has its greatest importance in the middle of Sweden, especially in the latitudes one or two degrees north and south of Stockholm, including the finely wooded provinces of Värmland and Dalarna. The forests are almost invariably of very simple composition. It is seldom that more than three species—pine, spruce and birch—occur together, but to a great extent pine or spruce occur also separately. The freedom of the forests from brush and prolific growths is striking, and simplifies also the work of the forester; even regions which have not undergone special care have a park-like appearance. Taking a common figure for both of the chief species, one might state that they reach a 10-12 inch d.b.h. 90 feet in height with a form quotient of .70 for pine and .65 for spruce at an age of 120 years. The coniferous forests are not encumbered with underbrush, but moss (most frequently *hylocomium*), whortleberry, crowberry and blueberry shrubs cover the ground, much given in the north to the formation of raw humus. Birch occurs everywhere, its ground-improving quality being in evidence just as in

¹ I wish to express my thanks to Prof. Gustav Lundberg of the Department of Technology, Royal Swedish Forestry Institute, Stockholm, for his helpful criticism of this article.

America; it also follows in the wake of fires together with aspen. The forest fire danger, by the way, can be looked upon as a past thing now; the amount of burn each year being quite negligible from our viewpoint at any rate.

As regards other very important timber districts the whole of the north, called Norrland, is fairly well forested. Here at the present, exists an over-supply of old forests and too little young growth. A little absolutely virgin forest is yet in existence but most of the forests are disordered remains after the unsuccessful diameter limit cuttings—the only system practicable when woods had less value than now, and no consideration given to the welfare of the forest. While the wood, especially the pine, is of very good quality in the north, it takes 15 to 50 years longer to reach the same dimensions as in the south.

All the above mentioned coniferous forests are found in regions both undulating and very mountainous, which abound with driveable waterways, but the country is also infested with bogs and muskegs (of the sphagnum types), taking up 8 per cent of the area in the southern, and reaching 30 or 40 per cent in the northern regions.

The flat country of the southern extremity is mostly covered with hardwoods: beech, spruce, etc., on the small areas not taken up for agriculture.

The trained foresters are of three grades, namely, the Jägmästare, the Forstmästare, and the Skogvaktare or Kronojagare. The Jägmästare's course consists of a preparatory field practice course of ten months, then two and a half years at the Royal Institute of Forestry in Stockholm, where the curriculum is about as follows:

	<i>Per cent.</i>	<i>Per cent.</i>
Botanical Subjects	15.0	(F 5.0)
Geology and Soils	8.5	(F 2.5)
Zoology Subjects	8.0	(F 3.5)
Game and Hunting	3.5	
Law	8.0	
Chemistry	2.0	
Forest Economics and Statistics.....	5.0	
Bookkeeping	6.0	
Agriculture	3.5	(F 4.0)
Technology and Utilization	14.0	(F 25.0)
Mensuration	16.0	(F 30.0)
Silviculture	9.0	(F 30.0)
Mapping	1.5	

(The first figure is the percentage of total *lecture hours*, and the practical work, if any, is given in the two field summer courses of two and one-half months each. The time percentage for the summer course is indicated here by putting "F" before it.)

The Forstmästare, who cannot enter the State Forestry Service, gets only about three-fifths as much theory but is required to have at least two years' apprenticeship. The average have five years, owing to the great competition in getting admittance.

The Skogvaktare course corresponds to our ranger courses, being mostly field work, arithmetic, elementary mathematics, bookkeeping, mensuration, silviculture, etc., and lasting about one year.

Entrance requirements are: for the Jägmästare, university entrance requirements; for the Forstmästare, about what corresponds to three years of our high schools. The Rangers or Skogvaktare need only grammar school training but a lot of practice. All the students are chosen competitively; about thirty-three Jägmästare, and ten Forstmästare (in this latter course only about one-fifth of the applicants gain admittance), being admitted to the Royal Institute of Forestry each year.

FOREST REGULATIONS

The handling of woodlands is not unrestricted even on private property. There are regulations which compel the application of rational forestry everywhere and differ for different regions.

The law of 1903 stated generally "that the cutting of woodlands is not to be carried on in any way detrimental to reforestation," and provides for the establishing of "Provincial Boards of Woods and Forests." These boards employ a staff of trained foresters to enforce the forest law, to spread the knowledge of silviculture among the people, to give expert advice on and oversee the handling of private woods; all for very low charges and in many cases free. They also handle certain funds for reforestation purposes and carry on some of this work themselves.

Failure on the part of any owner to reforest ground in a given time after final cuttings may cause the local board to interfere and possibly plant the area at the owner's expense. The result of establishing "Provincial Boards of Woods and Forests" is very satisfactory, for useful information on silviculture and handling of woodland has been spread in every part of the land. In this way forest capital tends to increase.

The cost of keeping the organization and its staff is met by the levying of a small "forestry fee" on wood products; about 6 cents per thousand feet of lumber, and 13 cents and 8 cents per ton, respectively, for chemical and mechanical dry pulp; half this amount for wet pulp.

In 1918 further progress was made by passing a provisory law which has been permanently adopted since then. This new law states that "no cutting shall be carried on in a way not in accordance with the practice of good forestry." The meaning of "good forestry" has proved clear enough to prevent vandalism. This statement, although general and almost vague, not only compels reforestation, but also prevents the butchering of thriving young woods. The law promises to be effective not solely because of its wording, but more because it is intelligently enforced. The principles of forestry aim first at permanently increasing the revenue from the forests. This can only be done by protecting all fast-growing wood and keeping every suitable area under forests.

The 1903 law produced good results but it did not go far enough; in many cases the wood was cut without consideration for the regrowth, the land denuded, being declared "old pasture land" or "swamps," not affected by the law. The wasting of young wood when prices were high could not be prevented; it was merely necessary to reforest the land in some manner after cutting, in order to comply with the law.

It is evident that since any doubtful mode of cutting is liable to be stopped, individuals find it safer to seek the approval of the board, that is, to obtain the free advice of technical men before any cutting is undertaken. Obviously this is done more often from mercenary reasons, to make sure the lumbering operations will not be stopped. Regardless of the true reasons causing requests for technical advice, the result is beneficial.

THE EXPERIMENT STATION

The Central Experiment Station at Stockholm is divided into a Forest Department, a Natural Science Department, an Entomological Department, and a Department for Reforestation Trials in Norrland.

The Forest Department concerns itself with all silviculture, mensuration and regulation problems. At present regeneration and the development of stands under different treatments hold the general attention. About 1,200 sample areas are distributed over the whole land. Moreover, this department has many establishments for the cleaning and gathering of seed, which is furnished to any forest nursery at cost price.

The Natural Science Department handles all botanical, chemical, and meteorological questions connected with the work of the station. In-

vestigations on diseases and damages occurring in the forests on type and species and on soils are also carried on.

The Entomological Department is concerned with the matter of bark and wood borers, insects which destroy cones, and insect troubles in the nursery.

The Department of Reforestation in Norrland is a result of dire necessity in that respect in northern Sweden, and for the present it has on its program questions of local seed production and germination.

FORESTRY PRACTICE

It is worth noting that while there are forest regulations affecting private ownership, these do not affect greatly the companies proper who keep far within the bounds of the law, seeming to vie with each other in developing better systems and handling their woodlands for what is considered the ultimate best.

The forester does not have to advertise to let people know he is a useful individual; they know it. A lumber industry is not only one which cuts and sells timber, but produces it. There are no discussions about forestry on one side and lumbering on the other, such as we have here; no attacks or expressed opinions by practical (?) lumbermen. In this one respect at least the companies have a suitable and sensible organization which corroborates the fact that real forestry does not only mean the care and growing of forests, but also their exploitation; that is, forestry should include logging, or at any rate direct it as regards location and method of cutting. Consequently one sees forests handled by so called "Chief Foresters" who understand silviculture and lumbering problems, who are familiar with economic difficulties, and handle the whole on a business basis. They are answerable to the company, and have to decide the happy mean, when truly rational handling of the woods cannot harmonize with the dictates of necessity.

OPERATING UNITS AND SYSTEM

The Chief Forester (in the Government service, "Over Jägmästare") has under him "Revir Förvaltare" or division managers (generally a graduate Jägmästare or Forstmästare). These divisions or "Revir" in middle Sweden might contain about 75 square miles of woods for which a single working plan may apply. These divisions are further divided into districts of perhaps 13 square miles, each looked after by a ranger, and further subdivided into tracts which might be called the "working units," on which special statistics may be kept.

The ranger handles the work directly, having foremen, scalers, and markers under him. He keeps tab on wages, scaling, etc., and sends in pay lists and reports to the division's office for approval, which in turn sends in summaries to the Chief Forester's office.

The companies try as much as possible to have permanent forces of workmen who occupy dwellings and farms in different parts of the woods, being under contracts which, while giving them certain advantages, also guarantee the company a fixed minimum number of days labor. As can be conceived from this the manager is constantly confronted with a multitude of matters concerning house repair, construction, farming, and providing the workmen's needs. As the companies own certain tracts of country outright, these managers are sometimes like little kings, having power direct and indirect, social and otherwise, more than is healthy for the average mortal. While a wise manager can do a lot of good and holds a fitting position for European conditions—where the shades of feudalism have not departed so long ago—still a man unsuited to the place can cause a great deal of unpleasantness and to a "strictly neutral" observer, the causes of Bolshevism are not hard to find.

As to the small woodlots owned by peasant folk, these are not as a rule well handled, and have been ravaged a good deal in the past to bring immediate returns to their owners. In this respect the Government regulations have done a world of good. But the people in general are really interested in forestry; the forester's doings are seldom unduly criticized as he is considered "the doctor" in his special line. A good evidence of the interest in the welfare of the woods shown by the people, is the matter of forest fires; they are held as a public calamity.

I remember how, one day, during a dry storm in the hay season in Varmland, the lightning struck on a mountain side, causing a little cloud of smoke to rise above the trees. Although, owing to damp weather, there was no particular danger, an alarm was set up by all who had observed the smoke, and at once a regular stampede took place toward that distant spot. From the noise and energy displayed it seemed the poor fire must die of fright. Forest fire insurance under those conditions is not such an uncertain proposition.

THE FIRE LAW

The fire protection law includes a clause appointing a fire warden in each community of a certain size, held responsible for all matters

connected with forest fires and protection. All able-bodied persons are liable for fire fighting, and in critical cases, military help is immediately called. Military help, by the way, gives the most efficient fire fighting labor. It seems a pity that, even where possible, it has hardly ever been used in America; for, while getting fine field training, the men also do work of national utility.

MANAGEMENT

The actual handling of the woodlands can be briefly considered here, in three phases, namely, the inventory of resources, the working plan, and the carrying out of the plan in exploitation, etc. The many other subjects connected with forestry will be partly or wholly overlooked, since they may be of special, not general, interest.

FOREST ESTIMATES

Mapping and estimating are carried on either separately or simultaneously. The latter is more frequent. There are two extensive types, the "Norrländ Taxering" used in the extensive woods of the north, and the "Sörmlands Taxering."

NORTHERN CRUISING

This consists in first running strips, generally 10 meters wide, along a compass line. All trees over, say, 10 centimeters d.b.h. are calipered and marked down on a separate blank for each stand. The stands are described as to height, age, site quality, density, ground cover, etc., by the leader of the crew, who also notes the general topography. Strange to say, no contours are taken, the sloping of the ground is entirely lost sight of except where especially steep slopes are roughly located on the map. This omission is probably due to the fact that a minute personal knowledge of the ground always exists; then also operations are not carried on locally on such a large scale as to make such topography maps indispensable; moreover it seems that our simple and rapid surveying methods are not known to Swedish foresters. The strips are chained—often quite roughly—and the map is plotted to a scale of 1-2000 with strips 50 to 150 meters apart, and smaller scales for less intensive surveys (where approximations on the woods as a whole are required the strips might be from 1,000 to 4,000 meters apart). Sample trees are taken in some systematic way, by taking, for example, the tree nearest the hundred-meter pole. On these trees

the height is usually obtained with Christens hypsometer, the growth rings are got by boring. The thickness of the bark, form class, and other details are also noted down. The sample trees are never felled in the regular estimating. This occurs only in the more special investigations.

A crew generally consists of one leader and mapper, one compass man, two caliper men, two chainmen, and often also a recorder of sample trees. Thus eight men in all—a formidable array from an American standpoint—are employed. The chainmen and caliper men, however, can be of a cheaper class of labor. In this way they run about five miles of line in a day on the average, every phase of the work thus going on simultaneously.

The strips run out from parallel bases lying about 400 to 1,500 meters apart. One point that impressed me in this respect was that in all laying out of bases and control lines, trigonometrical methods are invariably conspicuous by their absence; they do not seem to even dare use any but right-angle methods in their work.

The woods are classified according to age or maturity (see further on, under Government regulations for cut computations). Observations are recorded on the extent of damage, the effect of previous silvicultural or other treatment, and the condition or presence of artificial reforestation or natural growth, etc.

Site quality is somewhat standardized for the whole of Sweden and is based on the "wood-producing power" of the site when occupied by its most suitable tree species. Thus the best quality can only occur in the south where climatic conditions are most favorable. Jonson has tried to standardize the numbering of site quality—the old production figures being but slightly altered. His system is in general use.

Normal density is indicated by the number 1, when the stand is considered as using the ground to its best advantage, decimals over and less than 1 indicate, respectively, the need of thinning or a more open stand.

The volumes are of course given in cubic meters of stem wood, and are now almost invariably determined indirectly by the form quotient and Jonson's tables, or even from felled sample trees taken before or after the survey and from which volume tables are compiled; the average height and diameter referring each stand to its particular volume table. This is quite correct considering the fact that for each region the form class variations seem to follow height variations

regularly enough. Any discrepancy in these primarily chosen volume classes could be adjusted later from the large sample tree material of the survey proper.

SOUTHERN CRUISING

The other types of forest estimate, so called "Sörmlands Taxering," used in the more valuable forests of the south, consists in first running parallel lines as before, but only to map the stands—using three men with compass and chain, then afterwards taking a sample strip covering only 4 per cent of a large stand, but as much as 10 per cent of a small one. No sample areas being taken on stands below a certain minimum size.

The volumes are determined from a number of sample trees taken on each stand. These used to be felled and sectioned, but are nowadays referred to regular tables by their form quotient.

REGULATION OF CUT

Without going into the old methods for determining the cut, it may be said that almost all the German methods and their modulations have been applied; the last to be extensively used was the so-called normal formula, where "annual cut equals twice the total volume of the stands divided by the rotation." This can be erroneous even when the forests happen to be "normal." The latest practice generally leaves as much leeway as possible for abnormal conditions. Speaking broadly, some formula is generally used and the first result thus obtained, compared with either normal or actual growth. Any desired modification is made using a so-called "temporary rotation" or reducing the result by a certain "factor," a procedure which looks like "making an excuse." The practice has suffered from a blind desire to use formulas, even in the almost abnormal forests of the north. Where a relatively intensive forestry can be practiced, as in parts of Sweden, the only guides in determining the cut under abnormal age conditions should be, first, the *object* aimed at as regards future forest conditions, and temper this effort according to the requirements of the industry, present economic conditions, and the state of the forests. Formulas should only be a last resort or a rough guide. The latest Government instructions (for the State forests) says that one may use any well grounded method for each case, or as a rule "let *final cuts* during one-third of the rotation equal the whole of the old stands plus one-half the middle-

aged stands." By middle-aged forests is meant those whose age lies between one-quarter and three-quarters the rotation. But in the north where forests are mostly very old, one does not consider the age of the wood but instead so-called maturity classes, letting "growing," "mature" and "overmature" stands correspond to the "young," "middle-aged" and "old" as given above.

As to yield tables that could be used in computations, there are good ones for pine, but rather loose information for spruce—nothing very definite. But the Experiment Station is working up a large amount of material in this respect and the matter will be less embarrassing very soon.

It is but seldom that any order is prescribed in the cutting of the stands for each year, but this may be done for a 10 or 20 year period. It is generally felt that it becomes impossible to follow any predetermined order; one is satisfied in having the cruiser give clear information regarding the necessity of cutting, thinning, or planting, etc., and follow these requirements as best one can. It must be remembered here that trained foresters are handling the woods and the results of each administration are easily controlled.

ROTATION

The rotation is there like elsewhere a hard problem to decide as to "whys and wherefores." The Swedes have gone through struggles between soil and forest rent, besides having had other original theories of their own but no definite result has been arrived at since there, as elsewhere, the figures rest in some respects either on thin air or on pure guesswork. The latest compromise is that the rotation shall be long enough to produce the maximum value of wood in conjunction with a reasonable amount of interest on the capital engaged (mostly wood capital) in producing it. These are two very uncertain statements since the first depends on how the forests are handled and the second is based on approximation in valuation which may be quite wrong for the future. But it is at least something to go by and satisfies the foresters' conscience. The rotation varies from 80 years, even 70 in the south, to 150 years in the north.

The working plan also concerns itself with the forestry system, to be employed, the care of the forests, silviculture, improvements, pasturage, wild hay meadows, roads, etc.

THE CUTTING

The method employed in final cutting is clear cutting with or without seed trees. The period of selection cutting with a diameter limit is passed. It had disastrous results in the north and shows plainly that this system is only practicable under favorable climatic conditions on good soil. There are, however, certain reserved areas, or regions adjoining the treeless highlands, which are cut with the greatest care and protected by special regulations to prevent, or at least delay, the lowering of the tree line. Here, a selection system is carried on, but only in such a way that existing wood conditions are either improved or not in the least manner disturbed.

Several methods, mostly German, have been attempted in the south to obtain natural reforestation; the successes seem to depend on the favorable sites.

Över Jägmästare Wallmo has introduced a system of group selection cutting, consisting in first selecting favorable open spots where seedlings are already found, enlarging the openings by cutting and thinning heavily a belt around them. The process is repeated every few years. While these trials have only gone well locally, the principals brought out in the matter of thinning and ground cover, have had a good deal of influence on the present practice. Each of these efforts show that natural reforestation is possible in each case under certain conditions, but the fact always remains that the cost of exploitation under extensive conditions, take undue proportions when one has to cut in a messy way. As mentioned above, clear cutting is now preferred, and is carried on, on areas ranging from belts 30 yards wide up to any size and irregularity of figure. Almost all companies are trying natural regeneration of course; and good results are often obtained, especially on the better kinds of ground. Scotch pine, for instance, is quite easily regenerated in the south and middle Sweden, on the so-called pine heaths, by leaving seed trees and working up the ground with a Finnish plow² or harrow; but also very often without this preparation, the pine's tap roots being of great importance in this case for withstanding exposure. As to the spruce, it can not so readily be left in the open as seed trees. Its seedlings, nevertheless, may first get a start under a relatively *strong overcovering*, and al-

² The "Finnish plow" has a share no larger than one of the large teeth of a corn cultivator. It is mounted on a large wheel which facilitates its being lifted over stones, roots and brush heaps.

though the majority of young plants may dry up after the stand is removed, enough seed comes in from the sides to furnish seedlings, filling in and insuring regrowth. That is, providing the cut is not too broad and wrongly exposed to the wind.

THINNINGS

Thinnings have been carried on for a long time, but until recently they were mostly light and moderate, or so-called "low" thinnings, and have not influenced the growth as much as the newer forms of so-called crown thinnings. The general practice is to thin as soon as the wood output will pay for the trouble. In southern Sweden it might begin quite early or at any rate after thirty years, when the wood obtained can be used for making charcoal; but in the north it may be considerably later, especially if the wood can only be used as pulp wood (which might be taken to about 4 inches d.b.h.). Broadly speaking, it has been the custom to consider thinning up to 10 per cent of the stand's volume as "weak" or "light," 10-15 per cent "medium," and 15-25 per cent "heavy," if the thinnings are repeated every *five years*.

The most modern principle is to keep the stands well closed until the trees begin to drop their lower branches, then to increase the degree of the thinnings, returning every 10 years for a cut of 20-30 per cent "from above," that is, with most attention directed toward the crown conditions. As opposed to the old practice, the "crown thinnings" aim first at giving the finest trees of the dominant classes better chance to develop by giving them room and light; then also, quite unlike what one used to do, to spare harmless young suppressed trees which keep the ground covered and in good condition by hindering the growth of undesirable vegetation which might establish itself after the thinning owing to the greater intensity of light. One is more and more convinced that the severer thinnings are going to prove more advantageous. In conclusion one may say that, from a silvicultural standpoint, thinnings keep two main objects in mind: (1) to maintain or increase the growth in value; (2) to keep the ground in good condition, especially before the final cut and regeneration.

LOGGING

The logging proper is invariably preceded by the marking and estimating of the tract, by a crew of two or three workers directed by a tally man. They may take sample trees to determine the volumes

and forms, or else other results previously obtained in the same or similar stands are made use of. The "measuring off" into logs of the tree classes marked down is often done first on paper giving an approximation on the best methods of cutting the number of logs, and their quantity and sizes, for saw timber, pulp, charcoal, wood, etc. Thus a fair knowledge of the cut exists before the winter operations begin.

As a rule the hauling distances do not exceed five miles, two miles are more common. One-horse sleighs are always used and the roads are quite narrow, so that very little road preparation has to be made during the fall. The cutting begins seriously about November and a certain amount of logs may be skidded together if the snow holds off for any time; but as far as possible hauling and felling keep pace with each other. By using myriads of small by-roads, or really paths, the hauler manages to gather his load where it was felled. The only "skidding" necessary is really done by a man who draws and rolls logs where they will be convenient for loading. For handling the logs he uses a sort of ice tong-like implement, peavies and cant hooks being entirely unknown except for a crude sort of a hook and ring with a club slipped through, giving an impression that it may be the peavy of our ancestors.

For felling, the snow is scuttled away and very low stumps are left, almost always flat with the ground or at least just at the top of any root swelling or deformation. Among the various saws used, one looking like a carpenter's saw is the favorite and is handled by one man. American cross-cut saws with two men are also seen, but the amount cut per man is not so great as in the other way. In most places pulpwood and even saw logs may be barked. It is, or was, done partly on account of a law protecting the fisheries, but it is also claimed that lighter logs have certain advantages. They are said to be about 8 per cent lighter to transport, easier to skid; they dry better, being thus better for floating; they are much easier to handle in driving and do not jam so easily; lastly pulp factories claim that it saves both barking and barking knives because the logs remain quite clean and free of sand. Yet this barking takes 40 per cent of the woodcutter's time.

After the tree is felled, trimmed, and perhaps barked, it is looked over and marked off into logs by a so-called "adapter." This man has very special work, and can waste or save timber for the company according as he is well trained or careless. He must be an expert at the judging of rot damage, the suitability of the tree for any set of logs,

and get the greatest value out of the tree. For it is found that certain log dimensions are most advantageous for sawing; such might be $8\frac{1}{2}$ inches, $9\frac{3}{4}$ inches, 11 inches, etc., and again the longer the log *up to a certain length*, the greater its value per unit of measure. An average saw log of between 14 to 19 feet in length and 7 to 9 inches average top diameter is most usual. The log marker may receive his instructions in several ways; some companies put up a set of rules which should suit the average tree of the region, and the marker adapts his trees according to the general principle; or else a table may be set up giving relative values for logs of different lengths and diameters, computed from the saw output, or obtained from the value of pulpwood, or from its value for any other form of wood utilization, from which costs of each log landed at the mill is deducted as well as mill losses on each size. The measurer or adapter is also used to control the carrying out of cutting regulations and to oversee operations; some companies obtain approximate figures on the way the cut turns out and the progress of operations from some data kept by him. The workers being generally paid by the piece, their wages are most often reckoned out from the markers' figures and tallies which can be quite well controlled in most cases from the tally lists obtained from the marking of the trees before felling began.

The hauling is done as mentioned on rather narrow sleds, the bunks being almost 4 feet wide, but the runners only 20 to 30 inches apart. They claim that it simplifies the road question to use narrow sleds, in any case, the roads are very often allowed to get into bad condition even when it could be avoided with a little care and foresight. The loads *average* between 70 and 90 cubic feet (about 600 feet b.m.).

The volume of the cut is determined by scalers when the wood comes forward to the river or on the ice; this work being made uniform by so-called scaling associations which have an official standing. The scalers are sworn in and are considered impartial. They do very accurate work and examine the wood thoroughly. They are closely checked by inspectors; a rescale is made on the least suspicion of error. Dishonesty in scaling is a very serious criminal offense. Log volume tables are made up for each region, using units of *cubic* measure. Logs are bark-marked and stamped on the ends.

THE DRIVE

The drive is very similar to the American drive, but as a rule more thought and care is given to the preparation of the streams. They

make use of almost every stream having a lake of two or three square miles storing capacity, much less water being needed to float the logs on account of the well placed improvements along the streams. This careful use of waterways is the reason why their average haul is relatively short. One may see thousands of logs go by in a little torrent, and return two weeks after to find hardly a trickle of water left, because the lake's storage water is all used up. On the main rivers, large floating associations are formed which drive and sort out the logs, having in this connection large "bundling machines," for the storing of logs in "close storage." The largest saw industries are situated along the Baltic, which, by the way, is closed half the year.

The Government sells its own wood by auction from the tree tallies made out by its men; the question of Government sawmills having once come up but never been practised otherwise than in a very limited way. Many small holders sell so-called working rights to large companies, whereby all trees over a certain diameter are taken.

INTENSIVE MANAGEMENT

While touching on the subject of exploitation, one should not forget some of what might be called the "forest by-products" which have so much to do with making forestry "intensive." One often hears about the intensive forestry of Europe; it does deserve mention, but the fact is that this intensity in the forest management is more connected with the density of population and needs of the industries than with any invariable brilliancy in the handling of the forests. They do the right thing because it pays. For instance, the woods get beneficial thinnings and the small stuff is cut out; but it can be turned into valuable charcoal in an earth "mila." The steel industry needs all the valuable charcoal it can get. It has been worth while to haul with horses to the railroad charcoal from woods as far as 18 miles away.

The fact that Sweden has a scattered population and practically no coal at all causes a great necessity of wood fuel. This was amply demonstrated during the war, when wood was even used for locomotive firing. I have seen also special cases, where regeneration was connected directly with a profitable use of waste. That is, in blowing out stumps by dynamite and using them in gas producers, or for wood tar production, either in the old earth kiln ("tjär dal") or in dry distillation plants. A gorgeous young growth almost invariably comes up on areas where stumps have been thus removed, providing, of course, that there is natural seeding from the surrounding forest or artificial sowing.

REFORESTATION

Regeneration is mostly obtained by planting or sowing in spots. To be sure, planting is a very positive way of getting a young growth started, but it is expensive. A fact not always heard of in America when referring to or praising the industrious planting in Europe is that labor has been two or three times cheaper than in America. Now that the price of labor is going up there also, one begins to look around for satisfactory regeneration, without such large expenditure. Luckily, many efforts have been quite successful. Artificial regeneration is still the sure cure but not always the cheapest method of getting a new growth, even considering that time in money and in natural reforestation, land might sometimes wait for its new growth. Sowing in spots made with a mattock or planting with 1.5 meters between the plants or spots (1,800 per acre)³ are the most usual methods. The ground is left untouched for a year or two after the cut to allow the débris to rot down somewhat, and the numerous bugs to disappear or else light burning takes place after the cutting and the ground is planted or sowed. Sowing has been widely adopted heretofore on account of its apparent cheapness. But in many places one recognizes now that the crowding in spots which takes place in earlier years can be quite detrimental to the growth and often, in the case of the pine, branchy dominant trees get the upper hand in the struggle for existence. One has had bitter experience in the sowing of the seed coming from tracts unlike in climate to that where the sowing was done. It was about the period of 1870 to 1880 when artificial reforestation had become popular that one looked around for cheap seed and found it in Germany. The knotty, unsightly young stands resulting from these early forest cultures were at first mistaken as showing that artificial reforestation was impossible and "unnatural." Now that the trouble has been discovered, planting is done with Swedish seed. (German spruce is however allowed in the south.) The removal of these forests long before they have reached maturity, is a serious proposition in some parts. It is principally for this reason that the Government has established seed collecting stations in each province. The type of tree already existing is the one best suited to the climatic conditions. Local variations in type is very evident in the case of the pine. The

³ Some planting in America has been affected at moderate costs by planting only half the amount of plants mentioned. In spite of the fact that this given number of plants per acre has been determined by experience, it will be interesting to see the results of these trials in a few years.

southern pine has a conic spreading crown while all the northern trees are more cylindrical in shape, having also a better stem form. This is thought to be nature's provision for protection against excessive snow accumulation on the tree crown.

Planting with the bore is done both in unprepared ground or in spots loosened with a mattock. Both German and Danish methods have been tried in the south where good soil will permit greater outlay in regeneration. One finds here large forests having an artificial origin; there are tracts where numerous 70-year-old plantations are to be found so that one can get a good idea of what results to expect in artificial reforestation. The period just passed has been partly marked by the fad of having as fine and as large artificially reforested areas as possible, this question often taking most of a forester's attention. But it was a very fortunate "fad." It seems now that forest culture has taken its place in the routine work and receives its limited attention, but no more; it is merely part of the business, just as logging, driving, etc., and one only tries hard to get it done cheaply and well.

PRESENT SITUATION

The "woods business" in Sweden is marked with uncertainty for the time being. Compared to the former American market, one can say that prices here have always been pretty high; yet optimism has not been lacking in economic figuring; a two per cent per annum price increase is figured on. The opening of the new forest areas and the changed conditions in the world's merchant marine might have its influence here. Two more points in their forestry policy are that one tries to produce volume rather than quality, and that large dimensions do not get much higher relative values in their economic figuring; that is, the tendency is for a shorter rotation. When the results of the steps now taken are attained it is likely that the world's supply of finer timber will not be so plentiful, virgin forests being then perhaps nearly exhausted. Will the present theory still hold true? And will, for instance, question and controversies like soil and forest rent be cleared up?

What Sweden has to offer in the way of forest and forestry practice is not as inconsiderable as one might imagine in reading opinions expressed in America a few years ago. Sweden was said to be a place where one could mostly see what should not be done. They have at least a half century start on us and their failures and successes should be particularly valuable to those interested in northern, more especially northeastern, conditions. They are fortunately trying to solve their difficulties in their own way, taking guidance from, but not following blindly, the results and solutions of foreign countries.

Those who examine the researches of Dr. Hesselman and investigations of other men at their experiment station will be impressed by the scientific conscientiousness and originality with which their work is carried on.

A PLAN FOR THE ADVANCEMENT OF FORESTRY IN WISCONSIN¹

BY DONALD R. BREWSTER

PURPOSE OF THE PLAN

This plan has been prepared by the writer in response to a request of the Committee on Forestry, Madison Section, Society of American Foresters, made at the first meeting of the committee, July 23, 1920. As a result of the discussion at the committee meeting it was decided that the time was ripe to take some positive and constructive action to promote the protection and growth of timber on Wisconsin's millions of acres of idle forest land. The committee conceived it as its proper function to take the lead in making plans for such action.

The six weeks following the committee meeting were devoted to a study of the forestry situation in Wisconsin and to corresponding or talking with a number of men throughout the country who have been more or less closely and prominently identified with forestry work in the different States. Many interesting facts, experiences, and points of view were brought to light in this study and a considerable amount of valuable and suggestive printed matter was accumulated in the form of bulletins and pamphlets. It hardly comes within the scope of this plan to include a digest of this information. It is all on file for the use of the committee in the working out of its plans.

THE FORESTRY SITUATION IN WISCONSIN

Out of Wisconsin's 35 million acres, 16 million are forest land or stump land. Of the balance, 15 million acres are in cultivated farms and 4 million acres are included in farm woodlands. Estimates by the Forest Service in 1920 place the remaining stand of merchantable timber in Wisconsin at about 2 million acres, leaving 14 million acres of stump and brush land. Most of this stump and brush land lies in the northern half of the State and large areas of it have been shown by a careful soil survey to be fertile, tillable soil well suited to the

¹ Read before the Madison Section of the Society of American Foresters, September 23, 1920.

growing of annual agricultural crops. Other large portions have a thin, acid soil of almost pure sand on which it is difficult or impossible to raise profitable crops. There are also vast tracts of rough, rocky, stony, peat and swamp soils which are unsuited for agricultural development. Time did not permit of a detailed check of the acreage of these various kinds of land, although the information can probably be obtained from the State authorities or Agricultural College. However, there is very good reason to believe that out of this total of 14 million acres of idle land, at least 5 million acres are essentially unsuited for profitable agriculture and are, on the other hand, best adapted for the growing of timber, in which use they are capable of producing maximum financial returns. Probably very much more than 5 million acres of this land is better suited for timber growing than for any other crop. But to be conservative, let us restrict our estimate of the area of true forest land to 5 million acres.

Now the question is, can Wisconsin afford to have this empire of 5 million acres remain idle and practically useless and unproductive as it is at present? One-seventh of the State—doing nothing and good for one kind of crop only. This timber crop is the kind of a crop which, once started, will require very little attention or labor but will go right on working night and day, year in and year out, producing wealth. The universal cry these days is production and more production yet right here in our midst is a productive resource of tremendous and vital importance to every citizen of the State which is not only idle but almost entirely ignored and neglected at a time when Wisconsin is paying millions of dollars a year in transportation charges to import lumber, pulp wood, and other forest products from the West Coast and Southern pineries.

This idle land is not only not a productive asset but on the other hand, it is actually a liability to the State. Such waste land becomes a football to be kicked back and forth, frequently abandoned for taxes or serving the purpose of speculators in robbing and deluding settlers who should be devoting their resources to the development of good agricultural land. The danger from forest fires is excessive on such land for no one cares what happens to it and it becomes a menace to surrounding lands. The rest of the State is required to provide roads, schools, public institutions, and other State activities for this unproductive waste land area. All tax payers share in this unnecessary expense.

But to no class of citizens is this waste so important and serious as to the farmers, particularly those men who are farming the agricultural land in the north half of the State in the region where most of the idle forest land is situated. In the clearing of our large agricultural areas the farmer has learned to think of trees as his enemies. In the case of forest land, however, just the reverse is true for the forests adjacent to his farm can be made one of his greatest sources of profit. Forests provide employment for local residents and for their teams during the winter months when farm work has largely stopped and teams are idle. This employment brings in a very welcome cash income to the struggling farmer who is trying to buy powder to clear his land and equipment to develop it. With year round employment possible more men will remain on the farms, thus providing more help during the busy summer season. With local logging and lumbering operations a comparatively cheap supply of common lumber is available for farm buildings and other improvements. The logging camps and business communities engaged in lumbering offer excellent local markets for farm produce and bring more people into the district which improves community life and increases property values. This leads to the more rapid development of all true agricultural land within the district. In short, farm crops and forest crops supplement each other and it is only by making the forest land of a district productive that the agricultural land can reach its highest productivity and value.

Without going into the many other familiar and unanswerable arguments in favor of making our forest lands produce timber instead of lying idle as at present, let us consider ways by which the people of the State may be shown the facts and may be organized to effectively remedy the situation.

A STATE FORESTRY ASSOCIATION NOT DESIRABLE

The first suggestion made was that a conference of those interested in forestry be called this coming fall to organize a Wisconsin Forestry Association. This association would then build up a large membership throughout the State, employ a paid secretary, and work actively in the interest of legislative and co-operative measures for the advancement of forestry in the State. From the experience of other States there appears, however, to be considerable doubt as to whether a conventional forestry association such as exists in many of the States

is exactly what Wisconsin needs or is the form of organized effort which will produce maximum results with a given expenditure of time and funds. Such associations are hard to organize, hard to finance, and may, if not properly administered, be more of an obstruction than a help to constructive forestry and more of a handicap than anything else to those officially in charge of forestry work in the State. Sentimental features are apt to be given a prominent place in such popular associations at the expense of the fundamental economic considerations.

FORESTRY IS A MATTER OF BUSINESS

Forestry is primarily a matter of business rather than of sentiment—a “business necessity,” as President Roosevelt pointed out in his message to the 57th Congress. It is believed, therefore, that the greatest progress can be accomplished in the shortest time if efforts are devoted to organizing the business and economic interests of the State into some effective means of promoting forestry as a strictly business proposition which promises to return a profit to everybody concerned. With increase in forest production this profit will come in reduced taxes because of the profits from State forests, in increased business due to lumbering operations, in decreased freight charges on forest products, in more taxable wealth for the support of roads and schools, in regulation of streamflow and conservation of water resources, in increased property values and recreational values, in stabilized communities and manufacturing industries, and in lower prices for forest products.

The State cannot get along without wood and its economic prosperity will demand cheap wood in abundance. The only way this wood can be obtained eventually will be to grow it. But growing timber is a slow process requiring at least 50 years. Our present supply of timber if cutting continues at the present rate is estimated to last not more than 20 years more. It is obvious that if our paper mills, our furniture factories, our farms, and our cities are to have enough wood after that 20-year supply is gone, steps must be taken immediately to start a new crop of trees growing on at least part of that empire of idle forest land which is larger than the whole State of Massachusetts.

If this 5 million acres were stocked with thrifty young timber it would be producing a net annual yield of at least 300 board feet per acre or 1,500,000,000 feet per year. At the low stumpage value of

\$10 per thousand feet this would amount to \$15,000,000 per year. The value of the forest products obtained would be at least three times as great so that the total wealth produced by this timber land would be at least \$45,000,000 per year. And this would all be coming from land which is good for no other productive purpose. It must either grow trees or be useless for anything. To be sure, it will be many decades before all of this area can be put into a productive condition. Yet that is no reason why a start should not be made, and made at once, if the business men of the State can be aroused to the need for immediate action.

The citizens of Wisconsin must be brought face to face with the fact that forestry is not optional but is truly a "business necessity" if privation, inconvenience, slowing up of industry and development, and eventual disaster are to be avoided. These things may not become serious factors in our generation but there are surely many forward-looking men and women in the State who are willing to unite together in taking action to protect their children and grandchildren from the harmful and certain results of a continuation of the present policy of almost criminal neglect of our forest resources. Indifference, ignorance, and procrastination should no longer be allowed to hinder the State from facing and solving this fundamentally important and vital problem of restoring to a productive condition the immense empire of idle forest lands within its boundaries.

ORGANIZATION OF A FORESTRY COUNCIL

To be successful, any movement to improve present conditions must have the active support of an influential group of public-spirited men representing all important economic activities in the State. It is believed that the best form of organization for such a group would be as a Wisconsin Forestry Council, similar in character to the National Research Council and unofficial in its make-up and activities. The first work of our committee should be to quietly organize this council by personal solicitation. The Conservation Commission is in a position to furnish a large number of names of influential citizens throughout the State who have shown an interest in forestry. Undoubtedly the various members of our committee can suggest many other names from among their personal acquaintances and business associates.

The aim should be to try and obtain a small group of men from each congressional district who know each other and can work together

harmoniously and effectively as a unit. The experience gained in organizing similar groups in the Liberty Loan campaigns should indicate the best method to adopt in this preliminary organization work.

Each district group should form a committee with a chairman and should assume full responsibility for the active promotion of forestry in their allotted territory, including the raising of finances to carry on the work. The chairmen of the district committees, together with the officers of the council, should form the central executive committee of the State council and maintain direct contact with the central organization by correspondence, and attendance at meetings of the executive committee.

The State council should have a President, Vice-Presidents from different portions of the State, and a paid Secretary-Treasurer. This Secretary-Treasurer should be a man experienced in State forestry work, preferably a technically trained forester. It should be his duty to furnish the council and district committees with authentic information as a basis for conducting the work, also to carry on correspondence and publicity work, formulate plans, build up and maintain contracts with individuals and organizations throughout the State and in other States and, in short, to do everything possible to promote forestry work in the State. He should be paid a liberal salary commensurate with the vital importance of his work and he should be provided with adequate additional funds to maintain the necessary administrative organization.

The council could hold open meetings once a year or oftener for the purpose of discussing forestry matters for the public benefit. These meetings should be at different points in the State and might be made coincident with the meetings of other organizations such as lumbermen's associations, civic and commerce organizations, the Academy of Science, and similar well known groups who would be interested in forestry. In every way this council should assume the place of leadership in the forestry movement in the State.

Steps to organize the council should be taken as soon as possible this fall, so that the work may be well started by the time the legislature meets in January.

FINANCING THE WORK OF THE COUNCIL

If the business interests of the State can be made to see their direct financial interest in the advancement of forestry, it should be a simple matter to provide the needed funds. Each district committee should

be allotted a certain sum to raise, based upon the wealth and character of business development in the district. Or perhaps an equal sum from each district, say \$1,000 a year, would be preferable. In this way a fund of \$11,000 could be raised which should be more than adequate to put the movement on its feet.

The raising of any reasonable sum would be simple and would not entail a burden on anyone if the allotment work of each district committee were thoroughly done. Obviously the more contributors in any district the more people will be directly interested in the movement and back it not only in a financial way but also with their personal co-operation and political support. In return for their contribution their names could be printed in an attractive publication issued annually and they could be presented with a card to hang on their office wall showing that they are public-spirited co-operators in promoting forestry. Allotments to large organizations such as the railroads and telephone companies could be pro-rated to the different districts and cards given to each local station or branch office. By including 200 or more contributors in each district it should be possible to limit individual assessments to \$5 or less—enough to enlist their interest yet not enough to be felt as a burden.

Every type of organized activity in the State should be induced to contribute to this movement. The farm bureaus and other farmers' associations; the development associations, the land and timber owners, the railroads, telephone companies and other public service organizations; the lumbermen, the paper manufacturers, the furniture manufacturers and other manufacturing interests; the summer-resort men and everyone interested in promoting good roads and development of recreation facilities, including sportsmen and fieshermen; the power and navigation interests; the bankers, wholesalers and retailers; the architects and construction engineers; the scientific associations; the hotels and automobile interests; the lodges and fraternal organizations; the newspapers and publishers; the labor unions; the political party organizations; the State government, including the University; the county and township governments; the educational interests; and many other economic and social groups should be included.

ACTIVITIES OF THE COUNCIL

The activities of the council would of course be determined by its executive council. It is sufficient at this time to point out some of

the many things which need to be done and which would serve as a thoroughly worth while reason for organizing the council in the first place. Briefly the council should work for the following objectives:

1. *Efficient prevention and control of fires on forest and wild land*, so as to reduce the forest fire hazard to the proportion of an ordinary business loss, averaging only a small per cent over any period of time. Fire protection is fundamental to all forestry work and requires concerted public action for effective results. The council should be instrumental in investigating the whole subject of forest fire prevention and control and in formulating detailed plans for the development of a patrol system, watch tower and telephone system and fire-fighting force, as well as for the education of the public to be careful with fire in the woods. One very valuable and effective thing that could be done immediately would be to bring pressure on the State's congressional delegation to actively support the request of the United States Forest Service for a large increase in the fund available for co-operation with the States in forest fire protection. Federal leadership and assistance in this respect offers more promise of results than anything else that has thus far been proposed.

2. *Expansion and development of State forests through an amendment to the State constitution permitting the State to practice forestry on its own lands.* The growing of timber is such a long time project that public institutions are best adapted to carry it on. The State, with its immense holdings of land suitable only for forestry and recreational purposes would be in a position to take the lead in timber growing if this amendment were passed. In a comparatively few years the State forests could be brought to a condition of profitable productivity and would in less than half a century be producing a direct revenue large enough to reduce materially the tax burden of the State government, as well as bringing many indirect benefits to the entire population by providing a local supply of timber. The area of State forests should be greatly enlarged.

3. *The acquirement by the Federal government of compact areas of forest land in Wisconsin for development as National Forests.* On these forests the Forest Service would have an opportunity to develop the best methods of fire protection and of cutting and reforestation adapted to Wisconsin conditions and could render a very valuable service in setting an example for State forests and private owners to follow. Every acre in these forests would be one more acre which

would be carefully protected and put to work growing timber for the good of the entire State and which would pay its share of the cost of local roads and schools.

4. *The passing of legislation providing for needed reforms in forest taxation to encourage the growing of timber by private owners.* As long as timber is taxed each year the same as an annual crop, private timber production will be financially a losing enterprise. Timber must be taxed as a periodic crop at the time it is cut, the only annual tax being a nominal tax on the land only.

5. *A survey of the State's timber resources and a classification of lands to determine those best adapted to the growing of timber crops.* In drawing up adequate plans for developing the timber resources of the State it will be essential to know much more definitely than at present what those resources are, both in young and mature timber and in lands adapted to permanent timber production.

6. *Laws to assist in the financing and insurance of timber crops.* In addition to tax reform it will be necessary to reduce the carrying charges and increase the safety of the investment in order to make timber growing profitable and attractive to private owners. There will always be large tracts of forest land in private ownership and everything possible should be done to encourage the owners of such land to devote it definitely to the growing of timber crops. Laws are needed providing either for Federal or State forest loan banks which will make long-time loans at low interest rates on growing and well cared for forests. Also timber insurance companies or agencies should be organized either publicly or privately so as to distribute the risk of loss from fire, insects, winds and other destructive agencies.

7. *The establishment of a Federal or State forest experiment station to study the technical problems of Wisconsin forests.* The value and necessity of research work and of scientifically established facts is coming to be recognized in every branch of human endeavor. In no activity is it more essential or badly needed than in forestry because mistakes made in handling a crop which matures only once in 50 or 100 years are so much more serious in their harmful results and difficult to correct than are mistakes made in growing annual crops or other work of comparatively short duration. Forestry experiments must often run through a long period of years before conclusions can be drawn because of the slow growing character of the crop. Yet our present information is very deficient on technical methods adapted to

the forest conditions in Wisconsin and a tremendous amount of additional study remains to be done. Adequate research should be started at once so that when the State eventually decides to go into timber production on a large scale, as it must in time, the technical information will be at hand to show the most efficient and profitable methods to follow in handling the trees and soils peculiar to Wisconsin forest lands.

SPECIFIC PROJECTS TO BE WORKED OUT

Specific projects would have to be formulated for the gradual accomplishment of the above objects. These projects should fall into two classes (A) legislative and (B) co-operative. Some of the projects which are of immediate importance are listed below:

(A) Legislative Projects

1. State.

- (a) Improvements in fire protective organization.
- (b) Amendment to Constitution permitting State to practice forestry.
- (c) Appropriations for enlargement of State forests.
- (d) Taxation reform providing taxation on yield.
- (e) Timber survey.
- (f) Timber insurance.

2. National.

- (a) Increased co-operation with States in fire protection.
- (b) Establishment of forest loan banks.
- (c) Acquirement and establishment of National Forests.
- (d) Establishment of Federal forest experiment station.

(B) Co-operative

1. Development of the popular interest in forestry through co-operation with the American Forestry Association in increasing its membership and assisting in its publicity work.

2. Development of co-operation of many agencies in educating the public to be careful with fires and in helping to fight fires.

- (a) Post offices by cancellation stamps and posters.
- (b) Business houses by fire protection stickers on mail matter and fire warnings in advertisements.
- (c) Lumber companies by better camp organization for fire fighting.
- (d) Fishermen and hunters and automobile tourists in putting out camp fires.

(e) Railroad companies by posters in stations and by spark arresters, patrol of rights of way and use of section crews for fire fighting.

(f) Newspapers and publishers in giving space to publicity material.

(g) Local and State officials in explaining and enforcing the fire laws.

(h) Timberland owners in providing special patrolmen for tracts of valuable timber.

(i) The University and Agricultural College in scientific studies of forest problems.

(j) Extension Department of the University and county agricultural agents in educational work in forestry and forest protection.

3. Assistance of farmers in increasing the productivity of farm woodlands and in obtaining a fair price for forest products.

(a) Furnishing of technical advice.

(b) Formation of co-operative marketing associations.

(c) Furnishing of planting stock of valuable species at cost.

4. Assistance of loggers, sawmill operators, lumber distributors, and wood users in the most efficient methods of handling forest products.

(a) The Forest Products Laboratory in distribution of general information and giving of advice on specific problems.

(b) Co-operative disposal of wood waste and development of new equipment and methods.

The above projects by no means cover the field and are only intended to be suggestive. They will serve, however, to call to mind some of the more important things which the proposed Forestry Council can turn its attention to for the general benefit of the public.

A PLAN FOR COMBINED INSURANCE AND FIRE PROTECTION¹

By DONALD R. BREWSTER

In trying to conceive ways and means for advancing the cause of forestry in Wisconsin a general plan has been worked out in my mind which would, I believe, make forest protection and insurance practically automatic and self-supporting throughout the State and at the same time steadily increase the area of timber producing lands under intensive forest management.

This plan is to assess all forest or wild lands in the State a small amount per acre to cover the cost of fire protection and insurance combined. Small isolated tracts, such as many wooded areas on farms or wild lands on which the tree growth amounts to very little and which are not a menace to surrounding tracts of forest land, could be exempted from this tax either at the request of the owners or the State authorities. The result would be to confine the tax and the protective efforts to those extensive and more or less continuous tracts of forest land on which the tree growth is of definite value or on which the worthless brush and weeds would be a menace to surrounding tree growth if unprotected.

On these brush lands the humus and other combustible fertility in the soil could be considered sufficiently valuable to warrant a small charge for protection and a low valuation for insurance. Furthermore, if fire were kept out of the brush lands for a period of years, commercial tree species would gradually come in from adjacent timbered areas and a valuable stand of timber would eventually result if the land were not cleared for farming. Wilful burning of wild brush land in order to collect the insurance could be avoided by making the minimum value for such lands little more than nominal and by making such wilful burning punishable by a heavy penalty. This combined with an organized system of inspection and appraisal with conservatively low valuations throughout, should keep wilful burning and criminal negligence at a safe minimum.

A minimum insurable valuation of \$1 per acre should be given to all lands included in the protected districts. These lands would be assessed

¹ Read before the Madison Section of the Society of American Foresters, September 23, 1920.

a minimum amount of two cents per acre per year for protection and insurance and \$1 per acre would be paid to the owners of all lands burned over where the owner was not at fault.

At the option of the owner, the insurable value of land containing young or mature timber of commercial species could be declared higher than \$1 per acre up to a maximum of say \$50 per acre. In all such cases a field inspection by an appraiser would be made unless the appraiser were already familiar with the tract. An additional assessment of 1 per cent of the appraised value would be added to the minimum tax of 5 cents, making the tax for timberland worth \$50 an acre total to 52 cents per acre.

Provision would be made for reducing these charges as rapidly as the efficiency of the protective work increased. A sufficient charge should be made, however, so as to build up a surplus for investment which would be available in case of an unusually bad fire season. A definite part of this surplus could be set aside each year for the purchase of forest lands by the Forest Fire Insurance Fund and for planting and placing these lands under intensive forest management as a profitable permanent investment.

More definite facts would be needed in order to decide the exact rates to charge. But let us work out a hypothetical example. We will assume that out of the 20 million acres of wooded and wild lands in Wisconsin 10 million are of such a character and so located as to come within the protection and insurance act. This would bring in a base income of \$200,000 from the minimum charge. Add to this the additional assessment on 2 million acres of mature timber of an average valuation of \$20 an acre amounting to \$400,000 more. In addition to this fund a contribution of \$50,000 should be made from the hunting and fishing licenses for forest protection and an additional fund of \$50,000 could be expected in the form of Federal co-operation in fire protection. This would make a total of approximately \$700,000 available annually for protection and insurance.

Suppose that an average of 50,000 acres or one-half of one per cent of the protected area is burned over each year and that 90 per cent is brushland of minimum valuation and the other 10 per cent timberland of an average value of \$20. Insurance payments would then be \$40,000 plus \$200,000, or \$240,000. Suppose that the cost of fire protection totaled \$200,000. A balance of \$260,000 would then be left. Suppose that the cost of insurance and appraisal came to \$60,000. A surplus

of \$200,000 would then remain for investment, half in timberland and half in liquid securities. In normal or subnormal years this surplus would keep building up. The income from liquid investments could be used for improvement of the timberland. Then in abnormal years the liquid investment could be drawn upon to meet heavy losses.

In the first years a larger base assessment of say 5 cents per acre would be safer. As a comfortable surplus was accumulated the charge could be decreased. Eventually in from 50 to 100 years it is conceivable that the income from the timberlands owned by the fund would be sufficient to entirely carry the cost of protection so that the charge could be reduced to a pure insurance basis.

In order to take advantage of existing agencies the administration of this law should be handled by the Forest Fire Insurance Department of the Conservation Commission. In conjunction with the existing fire protective system the protected zone would be divided into districts corresponding to counties, each district in charge of a supervisor who would employ a force of patrolmen and appraisers to carry on the protection and insurance work with an allotment based on the tax received from his district. The appraisal work could be simplified by a general survey and classification of each district.

State and Government lands would be exempt from the assessment and insurance provisions but would be included in the protected districts.

There should be some sort of a disinterested board of review which should decide all disputed claims and appraisals and have general oversight of the administration of the law.

The advantages of such a combined insurance and protection law would be that the property owner in paying the assessment would feel that he was getting a run for his money so that in case protection failed he would get something back in the form of insurance. This automatic distribution of risk through insurance, if combined with tax reform would make the growing of timber a much safer and more attractive investment than at present for the private owner. The increasing area of forests owned and managed by the fund would serve as a splendid concrete example of the attractive features of such investments and would stimulate similar investments by other public and private agencies. The making of loans at low interest rate on growing timber would be much more feasible with this insurance provision, owing to the much smaller risk of total loss.

CHAPARRAL COVER, RUN-OFF, AND EROSION

BY E. N. MUNNS

Forest Examiner, U. S. Forest Service

In September of 1919, two fires occurred on the Angeles Forest which burned some 150,000 acres of brush and forest land as severely as any fire of which we have any record. The two fires occurred simultaneously and were spread by a high north wind much more rapidly than any fires of which we have record. This wind caused the fires to burn much more intensively than the usual chaparral fire and, as a corollary, much more severely. It is known that in one place the fire swept over five miles in twelve hours, traveling uphill and downhill at practically equal rates, burning almost continuously across a broad front roughly three miles in width. Both fires were put out by a rain of fairly high intensity which amounted to several inches in three days. On Sister Elsie Peak, elevation 5,000 feet, a recording rain gauge registered 4.50 inches for the storm, though there was much less rain over the entire area.

The present discussion is limited to four areas known as San Dimas, Pacoima, Little Tejuanga, and the Dalton Canyons. All these drainage basins were completely burned over by the two fires, with the exception of San Dimas, in which 40 per cent of the cover at the lower elevations on the south and west slopes was destroyed. Cover conditions on these areas prior to the fire have been described in detail elsewhere but a resumé of conditions as existed is necessary to understand the changed conditions.

The soil of the San Gabriel Mountains is derived from a rapidly decomposing granite which outcrops in many places, and the average soil depth is over two feet for the entire area where it occurs. In the Tejuanga-Pacoima region, past erosion has exposed a sandstone conglomerate which covers approximately a fourth of the Pacoima and a third of the Tejuanga drainage. Here the brush cover was not as dense nor as complete as elsewhere and erosion was widespread and severe. There is very little permeable surface soil, but the sandstone itself is probably more or less porous and absorbs considerable moisture in a rain of long duration, though a heavy rain undoubtedly would immediately run off without much absorption.

The chaparral cover on sandstone areas was decidedly scanty and composed chiefly of tarweed, sage, and chamise with a density of .3 and a protective value from an erosion and water standpoint of .2 on a scale of 1.0. The granitic soils supported a much better stand of chaparral with a mixture of the brush species, the composition and density of the stand depending upon the depth of the soil, degree of slope, elevation, exposure, and physiographic location. Erosion was slight and confined to areas where the soil mantle was shallow, as on steep slopes or on isolated areas where landslides had occurred. There was a heavy brush cover in the Dalton and San Dimas Canyons, rather uniform as to height and density, and very few places where much rock outcropped to any extent. The early examinations of the area disclosed no evidence of erosion from the sidehills, which would certainly have shown up in the heavy storms of 1914 and 1916, though there was considerable erosion of the stream bed itself, due to the high velocity and volume of the water during the floods.

The condition of these drainage basins with their areas is shown below, together with the other drainage basins in which the fires burned in 1919.

Drainage basin.	Area, square miles.	Protection value of cover, 1917.	Area burned, 1919.	
			Square miles.	Per cent.
Pacoima	28.1	.7	28.1	100
Little Tejunga	17.8	.4	17.8	100
Big Dalton	7.6	.8	7.6	100
Little Dalton	3.2	.9	3.2	100
San Dimas	18.1	.9	6.5	36
Big Tejunga	105.5	.5	32.5	30
San Gabriel	211.4	.6	72.0	34

CONDITION AFTER THE FIRE, OCTOBER, 1919

The area burned over by the two fires was first examined in October, about a month after the destruction of the cover. At this time the amount of vegetation not destroyed in the path of the fire in these areas was limited to much less than one per cent of the total, and found in isolated spots on the sidehills where the fire had jumped, or in the bottom of the drainage basins where the fire burned more slowly or where natural barriers interfered with its progress to such

an extent that it did very little damage. Over most of the area all the brush was consumed except along the points of the ridges where the fire burned less fiercely than elsewhere. Occasionally there are large patches which probably burned slowly, as at night, where charred stems still remain with only the leaves and smaller twigs consumed, but it may safely be said that 75 per cent of the area was burned clean.

The change in the cover conditions was immediately shown both by stream flow and by erosion. In general the peak of high water came sooner from the denuded areas than from areas with a chaparral cover, the high water passed more quickly and normal conditions of flow were established sooner. Further, the water contained large quantities of silt, while streams from the unburned area were practically clear, though at times the water was slightly murky from the organic material and finer silt it carried.

There was also a difference in the quality of the water. Streams from the brush-covered area were running clear in October and were tasteless, while streams from the burned-over area were decidedly brackish and contained more or less mineral salts from the ashes of the forest cover. In the Little Dalton, the water in the pools was so decidedly bitter after the first rains that it was unfit for domestic use. A complaint that the impregnation of the irrigation water with potash and other salts from the burned area would be dangerous to agricultural lands was raised, but it is not believed that such a statement had any justification, because such water would be of value as a fertilizer and the concentration of salts was probably not high enough to injure vegetation. Furthermore, the greatest concentration of salts occurred at the time of maximum run-off and during the peak of the flow, when but little if any water from the burned areas was used for irrigating purposes. At the close of the winter season, the water flowing from the burned lands was fully as good as that from the unburned area.

Erosion began with the first storm after the fire on most of the area and was located in the softer and deeper soils which previously had been protected by the brush cover. Apparently on areas where the brush cover was scanty there was very little erosion, because of previous removal of the finer soil particles due to the scanty cover. At the mouths of the smaller draws, debris cones were being formed and on practically every sidehill with a deep soil, erosion of the shoe-string type was typical. There were no landslides found, though the

indications were that some would form with further rains. In the sandstone region there was not a great deal of erosion, probably because of the heavier soil particles, the absorption of water, or the presence of a binding agent. Little erosion took place in the stream beds; for the streams did not respond markedly to this precipitation because the ground was exceedingly dry and absorbed a large part of the water. Where the water did attain a velocity of any consequence, the stream bed eroded to some slight extent.

Prior to the fire 238 small "check dams" had been built by the County Flood Control Engineer in the Little Dalton Canyon, which has an area of 3.2 square miles. After the first storms it was found that five per cent of these were completely filled in by deposits from small drainage areas above them, and an additional six per cent were partially filled from this same cause. It was estimated that behind all the dams there was in the neighborhood of some 600 cubic yards of material, and that altogether in this drainage basin 2,500 cubic yards of material had been moved from the sidehill into the stream beds or small draws whence the winter rains would carry the material into the main stream. In one small side canyon 26 of these small dams were constructed. The lower end of this basin had not been burned over and twelve check dams were situated in that part of the area where the fire had occurred. Of these, five were completely filled by the first storm, three were three-fourths filled, and four more were partially filled, containing material up to one-half the capacity of the dams. At the end of the winter season the deposits had completely filled up twelve dams and there was more or less lighter material, such as leaf mold and litter, in the storage basins behind the dams. A storm of rather high intensity visited the region on the night of March 1, when the ground was fairly well saturated with moisture, with the result that all but one dam was completely silted in and this one contained considerable fine material which sealed all the crevices in the dam and formed a large pool.

It was estimated in the early winter that the number of chaparral stems which would not sprout would amount to some 40 per cent, but examination of a number of plots laid out on different slopes and aspects shows that only 3.5 per cent of the brush cover is not sprouting, and it is believed that this will still further be reduced by some of the stumps sending out sprouts later on in the season. In deep soil on gentle slopes where erosion had not been severe there was a

fairly good cover of annuals composed chiefly of species with hard seeds which lived through the fire either in the soil or in the litter itself. Much of the area was completely stocked with these annuals which form a most excellent protection against erosion. Where erosion is at all serious few plants and few species are found, the number present being largely controlled by the amount of erosion. That the seeds were in this finer material which was carried away by the first storms cannot be doubted, as the same species found on the slopes were obtained from the first alluvial deposits at the mouths of the draws, mixed in with fine leaf mold, litter, and soil.

The flow of the streams shows the same characteristics during the later storms as at first. There is a very sharp rise in the peak, a decidedly sharp fall, and a relatively low high-water stage following. From the areas with a brush cover the rise is not so steep, the fall is not so rapid, and there is a longer period of high water. Throughout the winter the water at the normal daily discharge from the burned lands was exceedingly dirty and samples of the water collected at flood heights in Dalton Canyon after light storms in March, 1920, show that as high as 90 per cent by volume was soil and only 10 per cent water. The percentages were determined by settling for ten days in pint jars. The total amount of sediment thus carried during the winter is beyond computing; and it is worthy of note that the same kind of litter and silt carried out from the burned areas was found in the San Gabriel River at the ocean, so that a large part of this most fertile material was carried to the harbor as well as being deposited in the overflowed lands during the high-water stage.

The deposits at the close of the rainy season showed that the bulk of the material had eroded from the steeper slopes and deeper soils and that as the season progressed coarser material and larger sized particles were being moved. A larger number of landslides were started and the shoe-string type of erosion was common everywhere on the slopes. Gullying by cutting and undermining was prevalent in many of the small dams, which will result in the lowering of the water-table and lead to still further erosion. The first of March it was estimated that 50,000 cubic yards of material had been moved from the Little Dalton Canyon since the fire and this figure was probably increased by the subsequent storms. The check dams built in the canyon were filled to capacity, and the original gradient of the stream re-established, but at an increase in height of about three

feet; and immense quantities of material moved out to the San Gabriel River.

To ascertain the effect of the fire on the chaparral a number of plots were laid out in November, 1919, and examined in March, 1920. These showed the species were rapidly recovering and the number killed and those alive are expressed in per cent in the following table, the data being given for slopes from 1,200 to 3,000 feet elevation:

Species	North		East		South		West	
	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive
<i>Adenostoma fasciculatum</i> ..	1.4	98.6	2.8	97.2	3.9	96.1	5.0	95.0
<i>Arctostaphylos patula</i>	16.7	83.3	22.4	97.6	14.3	85.7	.....	100.
<i>Ceanothus crassifolius</i>	100.	.....	100.	3.3	96.7	.....	100.
<i>Cercocarpus parvifolius</i>	100.	2.4	97.6	.....	100.	.....	100.
<i>Garrya veatchii</i>	100.	.....	.....	.....	.....	.....	.....
<i>Quercus dumosa</i>	100.	.....	100.	.....	100.	.....	100.
<i>Quercus wislizenii</i>	100.	.....	100.	.....	100.	.....	100.
<i>Prunus demissa</i>	100.	.....	100.	.....	.....	.....	.....
<i>Rhus diversiloba</i>	100.	.....	100.	.....	100.	.....	100.
<i>Rhus ovata</i>	100.	.....	100.	.....	.....	.....	100.

It is thus seen that there is but slight loss to the stand due to the fire and that the change in composition due to the loss of stools is negligible. The heaviest losses are largely on those slopes where the fire burned the more intensely; on other slopes the killing was in patches where the fire was intense, as evidenced by the almost total consumption of the stems as against the less severe fire where the stems were merely scorched and the smaller twigs burned.

The intensity of the fire is probably to have a decided influence upon the rate of recovery. It was yet too early at the time of examination to form more than a hypothesis in this regard. Sprouts were forming and growing, but the rate of growth appeared slow on those stools where the fire had been most severe, and in a number of cases the sprouts formed merely a fuzz. With the close of the present vegetative period, data on the rate of growth will be obtained as well as the sprouting capacity.

Some seedling growth was present, and those species which were recovering the slowest and with a higher per cent killed were represented by more plants than the others. Erosion, however, played an important part in that many seeds were washed away so that the

seedling growth that came in was on soil not badly eroded in the first storms. The species which were so represented and the proportion they formed of the seedling growth on the plots laid out is as follows:

<i>Species</i>	<i>Per cent</i>
<i>Adenostoma fasciculatum</i>	42.4
<i>Arctostaphylos patula</i>	17.1
<i>Ceanothus crassifolius</i>	37.1
<i>Cercocarpus parvifolius</i>	2.4

The effect of plant cover in preventing soil erosion was well demonstrated. Over a large part of the area under the chaparral cover grow a number of small "moss-ferns" (*Gymnogramma triangularis*, *Pellaea andromedaefolia*, *P. ornithopus*). These plants, while absent in heavy mixed stands, are nearly always present on the thin soils and under the scanty cover condition of the almost pure stands of *Adenostema* at the lower elevations. On these shallow soils and unfavorable sites these plants form an almost continuous carpet, protecting the underlying soil from washing. The root systems are exceedingly fine and decidedly fibrous and, while only going to a depth of four inches, are difficult to tear apart. Such a heavy turf prevents any soil loss as long as it is not broken; but once the surface is broken, erosion takes place readily by undercutting. Other plants act similarly but they usually do not form so heavy a sod though there are many species. Most of these plants have either a very light seed capable of being blown over long distances, or a seed with a very hard and impermeable seed coat which can endure heat for a short time without injury, and can lie dormant for a considerable period.

On eroded soils very few herbaceous plants of any species can be found, the presence of a plant being largely due to the accidental factor of catchment, as against a burned stool, stone or twig, or to the accidental factor of the action of fire in passing lightly over a patch of litter and not burning the compacted litter at the surface of the soil. In such places the species which came up were the same as given in the list following though their occurrence was conditioned by chance.

On non-eroded soil, the ground was often entirely carpeted and the stand of annuals complete. Other places, some species were not so well represented as on others probably because of the factors of

distribution, destruction of seed by birds, and the severity and heat generated by the fire in passing over the area and in burning the litter. The following list of species is not complete, as many plants were not seen in flower and were not identified by the grosser characteristics. The occurrence of the species is indicated by the symbols A, C, O, standing for Abundant, Common, or Occasional. Species which might be classed as Rare were omitted from the list as they might later become more abundant. Those marked with a small circle (degree mark) are from roots, corms, or underground stems and not from seed.

A <i>Gymnogramma triangularis</i> ° Kaulf.	A <i>Lupinus (grayi?)</i> ° Wats.
C <i>Pellaea anisromedaeifolia</i> Fee.	C <i>Lupinus</i> sp.
C <i>Stipa coronata</i> Thur.	C <i>Lathyrus latiflorus</i> Greene.
O <i>Muhlenbergia</i> sp.	C <i>Hosackia</i> sp.
O <i>Koeleria cristata</i> Pers.	A <i>Hosackia glabra</i> Torr.
O <i>Poa scabrella</i> Benth.	C <i>Vicia</i> sp.
O <i>Festuca</i> sp.	C <i>Arctostaphylos patula</i> Greene.
C <i>Bromus hordaceus</i> Lim.	C <i>Oenothera</i> sp.
C <i>Bromus rubens</i> Lim.	C <i>Ceanothus crassifolius</i> Torr.
A <i>Brodiaea capitata</i> ° Benth.	O <i>Sidalcea</i> sp.
O <i>Brodiaea crocea</i> Covill.	O <i>Convolvulus occidentalis</i> ° Gray.
O <i>Iris hartwegii</i> ° Baker.	O <i>Gilia</i> sp.
C <i>Eriogonum fasciculatum</i> Benth.	C <i>Echenocystis macrocarpa</i> Greene.
C <i>Erodium cicutarium</i> L'Her.	C <i>Phacelia</i> sp.
O <i>Paeonia brownii</i> Doyl.	O <i>Audubertia polystachya</i> Parish.
O <i>Delphinium parryi</i> Gray.	O <i>Solanum xanti</i> Gray.
O <i>Argemone platyceras</i> Link.	O <i>Pentstemon</i> sp.
O <i>Platystemon californicus</i> Benth.	C <i>Castilleja foliolosa</i> H. & A.
C <i>Eschscholtzia californica</i> ° Cham.	C <i>Hazardia squarrosa</i> Greene.
O <i>Lepidium nitidum</i> Nutt.	O <i>Erigeron foliosus</i> Nutt.
A <i>Adenostema fasciculatum</i> H. & A.	O <i>Achillea lanulosa</i> Lim.

From the burned area samples were taken in October, 1919, of eroded soil and litter found in the small alluvial cones where changes in gradient occurred, of the heavily burned and badly washed soils, and of non-eroded litter and soil in nearby areas of unburned brush. These samples were carefully sown and watched during the winter of 1919-1920 and the plants given in the following table were known. A few cases are given where there is some doubt as to species, though the great abundance of a species on the area made it certain that these were the same.

Species	Alluvial wash	Unburned litter and soil	Heavily burned and eroded soils
<i>Stipa coronata</i>.....	.....	X	.....
<i>Muhlenbergia californica</i>	X	.....	.....
<i>Bromus hordaceus</i>	X	.....	.....
<i>Bromus rubens</i>	X	X	.....
<i>Erodium cicutarium</i>	X	.....	X
<i>Arctostaphylos patula</i>	X	.....	.....
<i>Adenostema fasciculatum</i>	X	.....	X
<i>Lathyrus laetiflorus</i>	X	.....	.....
<i>Hosackia glabra</i>	X	X	.....
<i>Hosackia</i> sp.....	.....	X	X
<i>Vicia</i> sp.....	X	.....	X
<i>Ceanothus crassifolius</i>	X	.....	X
<i>Ceanothus</i> sp.....	.....	X	.....
<i>Achillea lanulosa</i>	X	.....	.....
<i>Convolvulus occidentalis</i>	X	.....	.....

The difference between the samples is quite striking when compared with the first list. It is readily seen that with the first rain of any consequence, the seeds of herbaceous plants in the surface soil and litter are almost entirely removed from the area, and that there can be no question as to the source of the plants which spring up on the area after a fire. The almost total absence of plants from the eroded and burned area is readily explained, and it is conceivable that more seed is lost by erosion than by the fire itself, though a fire which consumes all the litter probably destroys a large amount of seed through heat action in addition to that burned.

Those seeds which escaped the fire and erosion are heavy seeds, except *Erodium cicutarium*, and have hard seed coats. In addition they were from ten to twenty days later in germinating than the same species from the alluvial fan. The only explanation possible for this phenomena is that these seeds were buried in the surface soil and were seeds from previous years and had been lying dormant for a considerable time, while the seeds found in the washed material were relatively fresh and from plants that had grown in the chaparral stand more recently.

The character of the soil as to its physical and chemical properties is being made a subject of investigation, as well as the effect of the different soil classes upon the rate of growth and development of plants.

AMERICAN TREES FOR FOREST PLANTING IN FRANCE

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Recently there has been much discussion of the possibility of the use of American tree seed and nursery stock for forest planting in the devastated regions of France.

French foresters have for many years experimented with exotic species and are familiar with the possibilities of most of our American trees. They are perhaps more familiar with the planting possibilities of some of our western conifers than are we ourselves.

It may be of interest to American foresters to see just how some of our American species are regarded by French authorities. Accordingly there follows an annotated translation of the notes on American species taken from the list of exotics mentioned in the latest edition of a standard French textbook on forestry. This book is entitled "Sylviculture" and is by Albert Fron, an inspector in the Department des Eaux et Forêts. The book is part of the *Encyclopédie Agricole*, from the Press of Bailliére et Fils, 19 rue, Hautfeuille, Paris. The last edition is that of 1918 and considers the lessons of the war, and is therefore in every way up to date.

To start with, it may be interesting to quote from the author's discussion of the value and use of exotics in French practice beginning on page 170; he says:

"Forest owners may in some cases make advantageous use of certain foreign species. It would quite evidently be a large error to give preference to exotic species over indigenous ones; the former should never, save very rarely, occupy other than a secondary place in the forest. In an accessory rôle, they may be introduced into a stand, sometimes in mixture, or in small groups, sometimes on the edges of the woods and sometimes along roadsides.

"To proscribe them entirely would be to fall into an inverse exaggeration, since there are without doubt certain foreign species able to render us great service.

"Several have already proved their value and have taken their place in our forest flora. The Austrian black pine (*Pinus Laricio*, var *Austriaca*), a species to all intents foreign. The Weymouth pine

(*Pinus strobus*), the false acacia (*Robinia pseudacacia*), the American red oak (*Quercus rubra*) are all examples.

"The Scotch pine (*Pinus sylvestris*) itself, is it not an introduced species in most of France? Is not the same true of the maritime pine (*Pinus pinaster*) in Sologne?

"Other exotic species as yet little represented in our forests have shown themselves very hardy and fertile in several localities. They are, therefore, susceptible of complete naturalization.

"Outside the question of its climatic adaptability, a foreign species merits introduction into our forests if it is able to fill one of the following conditions:

"(1) If it furnishes products of a superior quality to those of similar native species.

"(2) If it produces an equal or even a slightly poorer quality of commercial timber in the same or somewhat shorter space of time.

"(3) If it furnishes special products which cannot be obtained from indigenous species and which we must import from foreign countries.

"(4) If, even though it furnishes a wood inferior in quality and quantity, it recommends itself because of its resistance to wind, drouth, frost or other unfavorable condition; if, in a word, it presents decided advantages over indigenous species in point of view of its adaptability to particularly difficult conditions of soil or exposure.

"It is decidedly evident that species should be introduced into the forest only after they have been planted in arboretums or parks and gardens and have proved themselves completely hardy in our climate. It is somewhat difficult to determine soil and site conditions under which exotic trees will grow, and even with species known to be hardy it is advisable to await the result of experiments whose objects are to determine just these things."

Following this discussion he lists some sixteen exotic conifers roughly in order of their probable importance for forest planting in France. Of these all but four are from North America, these being from Western Asia or Japan.

The list of hardwoods contains twelve species, all but two of which are North American.

In addition in his general discussion of French trees he includes the white pine and black locust considering them as now part of the forest flora of the country. For convenience these are here placed at the head of the respective lists of coniferous and of broad-leaved species.

In translating the scientific name has been placed first, followed by the French common name and its English translation, since the French common names may be met with in French literature where scientific names are not given.

In translating the attempt has been made to keep to the author's phraseology as closely as is consistent with good English so that the reader may realize the author's intended shades of meaning. At the editor's suggestion the translator has added certain annotations in parenthesis at the end of the discussion of each species where there seemed occasion for it.

Following is the list :

CONIFERS

Pinus Strobus; *Pin Weymouth* (Weymouth pine).—Originating in eastern North America, this tree has in France a rapid growth on the plains and in regions slightly elevated, having a deep soil, moist or slightly humid. It is a very hardy, light-requiring tree, forming a fairly complete overhead cover. It seeds early in life and thereafter regularly and abundantly every two or three years. Its rate of growth is active and well sustained. Forms good plantations in the regions to which it is suited. Its wood has various uses, such as carpentry, box making, and paper pulp manufacture. As a fuel wood it is only mediocre.

(This species was introduced into Europe about 1700. It is perhaps more commonly employed in Germany and the British Isles than in France. Boppe and Jolyet in *Les Forêts*,¹ a somewhat older textbook, state that one reason the species is less popular in France is because it is generally harvested before the heartwood has formed, and the sapwood is considered as not of great value.)

Thuja Gigantea (*T. plicata*) ; *Thuja giant* (giant thuja).—The giant thuja is a large tree which has shown itself to be very hardy with us; here it demands a fresh soil, somewhat firm, and with a certain amount of atmospheric humidity. It seeds regularly and abundantly. Has to be shaded somewhat during its early years. It is able to be grown in dense stands, and can be introduced into our forests for trial. It makes a rapid growth and furnishes light wood useful for numerous special purposes.

(This tree certainly has many desirable qualities, but Americans know it so imperfectly from a forest planting viewpoint that it is difficult to judge of its value for reforestation).

Chamaecyparis Lawsoniana; *Faux cyprès de Lawson* (Lawson's false cypress).—A large tree which has shown itself very hardy with

¹ Librairie J.—B. Baillié et Fils, Paris, 1901.

us, where it grows by preference in humid valleys. It demands deep fresh soils, of some fertility and a humid atmosphere. It prefers siliceous soils and grows poorly on limestones and heavy clays. It seeds regularly and abundantly, can be grown in full stands and may be introduced for trial. Having a fairly rapid growth, it presents the same interest as the preceding.

(This tree is well known in Europe as an ornamental tree, but it has never been used in the United States for forest planting, so little can be added to the above.)

Pseudotsuga Douglassi; *Faux tsuga de Douglas* (Douglas false hemlock).—This is a very fine American tree which has shown itself very hardy with us. It prefers deep siliceous soils, somewhat fresh, but it is content with relatively dry sands and a mediocre fertility. It always does badly on too dry a soil and will not grow on limestone soils, further it requires a humid atmosphere. This tree planted on plains and in fertile valleys has a rapid growth, and seeds regularly. The young trees require shade for their first three or four years. The tree can be grown in closed stands and may be introduced into the forest as an experiment.

(This tree has been successfully introduced into England as well as France. It was introduced into the former country about 1820 both as a timber producer and an ornamental. In fact it was from the English that its value for the latter purpose was first realized for the eastern United States.

Owing to climatic conditions probably seed from the Pacific Coast would give better results in France than that from the Rocky Mountains.)

Picea Pungens (*P. parryana*); *Epicca piquant* (Pungent Spruce).—This American tree has shown itself very hardy in France, and seems to be able to accommodate itself to moist even peat-like soils, sometimes also to dry soils. It is a good tree with a rapid growth, which can be planted from the lowlands to the upper limit of vegetation on all sorts of exposures. A species interesting to try out for forestation of moist soils and old pastures. Its very sharp and pungent needles defend it against grazing animals.

(This species was introduced into England about 1877 and later into Germany where it has given good results for forest planting. Because of its bright blue needles it is also grown to a considerable extent in Europe as an ornamental.)

Picea Sitchensis; *Epicéa de Menzies* (Menzies' spruce).—An American tree apparently hardy in France. It prefers fresh siliceous soils,

and requires a humid atmosphere. A fine tree with a rapid growth which can be planted from the lowlands to the upper limit of vegetation, on all sorts of exposures. It merits utilization for forestation of humid soils and pastures. Its sharp and pungent needles defend it against the teeth of animals.

(Little is known of the planting possibilities of this species, but it is a valuable and rapidly growing timber tree and should be worth experimenting with.)

Juniperus Virginiana; *Genévrier de Virginie* (Virginia Juniper).—Commonly called red cedar (*Cedre rouge*). A large tree of slow growth, seeming to be hardy with us and not to be exacting in point of view of soils, preferring however sandy regions fresh and rich in humus, but accommodating itself to light and dry soils. Because of its hardness, its slow growth, and above all because of the special uses to which its wood can be put (chiefly in the manufacture of pencils), it would be interesting to introduce into our forests as a trial species, especially on light soils along the sea shore.

(Because of its exceedingly slow growth French foresters will probably discover that there is little financial advantage in growing this species. It has, however, a distinct landscape value, and on estate forests it could easily find a place for this reason.)

Pinus Banksiana (*P. divaricata*); *Pin de Banks* (Banks pine).—Origin in America, able to give service for foresting poor soils at high altitudes, with a severe climate. Has a rapid growth. It seems to withstand dryness better than Scotch pine (*P. sylvestris*). It is able to grow on the most arid and sandiest of soils. It seems to prefer limestone soils, and can be tried on the poorer soils of exposed plateaus of southern France.

(The author's statement that this tree seems to prefer limestone soils is interesting since the tree does not do well on calcareous sites in America. It is doubtful if there would be any advantage in growing this species on sites suitable for Scotch pine as the latter yields a better grade of material and reaches a larger size.)

Pinus Rigida; *Pin rigide* (Rigid pine).—Of American origin, hardy, little exacting as to soil conditions, can render service in moving sands, notably in the dunes of the North where the maritime pine does not resist the climate.

(The author's suggestion to use this species for sand-dune work along the French Coast too far north for the maritime pine seems practical in view of its success on Cape Cod, the sand plains of Long Island, and exposed points on the coast of Connecticut.)

Abies Concolor and *Abies Grandis*.—Both are remarkable for their rapid growth in moist soils, which are somewhat fertile.

Brief mention is also made in the following expressions to: (1) *Librocedrus Decurrens*, yielding a wood for special purposes; (2) *Chamaecyparis Nootkatensis*, similar to *Chamaecyparis Lawsoniana*; (3) *Taxodium Distichum* (Chauve cypress), which planted along water courses assumes large dimensions and furnishes a wood of special character; (4) *Tsuga Mertensiana* (*Tsuga de Californie*), a tree of rapid growth, much more interesting from a forestry viewpoint than its relative *Tsuga canadensis*. (Apparently none of the above species have been planted to any extent in France.)

HARDWOODS

Robinia Pseudacacia; *Robinier faux acacia* (*Robinia false acacia*).—An American tree which has been introduced into France on the plains, hillsides, and the bases of the mountains. It prefers soils light and somewhat moist. It is hardy and grows more or less on all kinds of soils. It is intolerant, seeds abundantly in the autumn. Its seeds are easy to keep. They germinate in the springtime in from ten to fifteen days. It sprouts and suckers abundantly. It can be grown in simple coppice or coppice under standards. When planted upon a good soil it becomes a very fine tree and forms excellent open plantations. Its branches are easily broken by the wind. It is valuable for fixing eroding soils on slopes, because its root system is solid and wide reaching, and because of the facility with which it sprouts and suckers.

Its wood is yellowish, heavy, hard, elastic, and durable, being excellent for wagon spokes, rungs of ladders, parquetry, turnery, etc. It burns well and yields fair charcoal. Its leaves can be used for forage.

(One thing which gives this species a value in Europe which it does not possess with us is the fact that it escapes the ravages of the locust borer which makes its successful cultivation in America almost impossible. The black locust is probably the most common American tree species now growing in Europe. It is perhaps even more common in Germany than in France. The writer's general observations lead him to believe that the species is somewhat more tolerant in Europe than at home as would be indicated by the statement that it can be grown as coppice under standards.)

Quercus Rubra; *Chêne rouge d'Amérique* (American red oak).—A large tree with fairly rapid growth, which has shown itself to be very hardy with us, is strongly resistant to frost. It does well on the plains and in valleys. Does not seem to be exacting in its soil requirements,

and accommodates itself well to sandy soils of medium fertility, but grows badly on limestones. A species interesting to plant in trial plots along with our common oaks.

(Boppe and Jolyet in *Les Forêts* give this species an even more favorable write up, stating that it has been used quite largely in Belgium. It is certainly a desirable tree for cultivation at home.)

Quercus Palustris; *Chêne de marais* (Marsh oak).—A very fine tree of fairly rapid growth, very hardy in France. Seeks out moist or even wet sand plains and valleys. The best perhaps of the American oaks.

(An American might disagree with the author in his statement that this is perhaps the best of American oaks, but it should certainly do well on the sites which he mentions.)

Quercus Nana; *Chêne à feuilles d'Yeuise* (Green oak).—Small-sized American tree, valuable for use on dry sandy soils and on hunting preserves.

(The author is probably unacquainted with the extent to which this species can become a forest weed. It seldom becomes a real tree, and even though it forms a dense soil-binding cover it gains growth so successfully at the expense of more valuable species that its use would be inadvisable. Even as cover for shooting preserves it has the disadvantage of forming dense thickets—admirable refuges for the game, but almost impenetrable for the hunters or the beaters.)

Fraxinus Americana; *Frêne Blanc d'Amérique* (American white ash).—An excellent tree even more hardy and of more rapid growth than our common ash to which it is not inferior. It demands moist soils. It is worth propagating along the banks of streams and on soils frequently inundated.

(There would probably be danger in planting white ash in soils too frequently inundated or too swampy. Black ash (*F. nigra*) might be employed under those conditions.)

Juglans Nigra; *Noyer noir d'Amérique* (American black walnut).—An excellent tree with a more rapid growth than our indigenous species, and less exacting in soil requirements, very hardy, succeeds on moist sandy soils, but prefers those somewhat fertile. A tree able to live in close stands, yielding a wood of high value. Interesting to try in the forest and along its edges.

(It is, of course, difficult to grow black walnut in close stands, but under conditions of intensive culture such as are possible in Europe it ought to be easier than in America. The common walnut of Europe (*Juglans regia*) is not regarded as a forest tree so our species would not come into competition with it.)

Hicoria Alba and *Hicoria Glabra*; *Carya Blanc* and *Carya des Pourceaux* (White hickory and pig hickory).—Trees native to America, relatives of the walnuts, which have somewhat the same value and requirements as the black walnut.

(Apparently very little hickory has been grown in France, since there is no species having wood which closely resembles it, and its high technical value is probably unrealized. It is doubtful if the hickories ever become popular there. There would be the added difficulty of securing seed from the desirable species since it is doubtful if many French nurserymen are familiar with the specific identity of the large number of American hickories. The difficulty of handling these species in the nursery would likewise have to be reckoned with.)

Prunus Serotina; *Crisier tardif* (Late cherry).—An excellent tree, very hardy in our climate. It prefers soils mellow, moist, and deep, with a certain degree of fertility, but it accommodates itself to relatively poor sandy soils, and does not seem to dread limestone soils. This species even though its growth is slow is not without interest from a forestry point of view.

(Boppe and Jolyet in *Les Forêts* state that this species is frequently confused by nurserymen in France with *Prunus Virginiana*, the American choke cherry. Since the latter species is perfectly worthless from a forestry viewpoint, the importance of certified seed and stock in connection with this species is evident.)

Liriodendron Tulipifera; *Tulipier de Virginia* (Virginia tulip).—A tree interesting to propagate under the same conditions as the poplars, especially on siliceous soils.

Betula Lutea; *Bouleau jaune* (Yellow birch) and *Betula Lenta*; *Bouleau merisier* (Cherry birch).—Woods much sought after by cabinet makers.

In conclusion it seems sufficiently evident that it is important for seed dealers and nurserymen who contemplate shipping seed or nursery stock to France to understand fully the nature of the species required rather than to offer species suitable only for our own conditions. A recent communication of the Director General of the Service des Eaux et Forêts to the American Forestry Association emphasizes this. He says, according to the translation of his letter published in the September, 1920, issue of *American Forestry*: "Seeds of certain species that are little known in France . . . will be given special care and study and will be planted in the nursery of forest school at Barres." (The national arboretum is located there and most of the species mentioned have first been tested at this institution.)

The high regard with which certain of our western conifers are regarded in France might lead to experiments to show their value in our own country.

ARGENTINE AND PARAGUAY FOREST CONDITIONS

By W. R. BARBOUR

GENERAL INFORMATION

In this brief resumé of forest conditions as I found them on my recent trip to South America, I group together Argentine and Paraguay, as they are geographically and topographically continuous. Uruguay could also be included, but as it is nearly all open plains, what I shall say of the open country of central Argentine applies with equal force to Uruguay.

I think the region under discussion should be divided into the following forest regions: subarctic, alpine, prairie, subtropical, and the Chaco. Of all except the latter I can only speak by hearsay, except that I saw a good deal of the prairie region.

The subarctic region lies down in southern Patagonia, in the territories of Chubut, Santa Cruz, and Tierra del Fuego, regions with a very short growing season, heavy rainfall, and very sparsely settled except along the coast. There are said to be heavy forests of beech, comprising a number of species of *Nothofagus*. They are only used on a small scale for firewood and charcoal, though I understand one small wood alcohol plant exists.

The alpine region is confined to a narrow strip along the Andes, at a high elevation. Most of this alpine belt is on the west or damp side of the Andes, in Chili. The timber on the Argentine side is confined to south exposures and to narrow alpine valleys. Mixed with the *Gymnosperms* (*Libocedrus chilensis*, called cordillera cypress, and the following species all called cordillera pine, *Araucaria imbricata*, and *Podocarpus andina*, *chilena*, *nubigena*, and *Parlatorci*) are several species of *Nothofagus*. They are chiefly found in Chubut and Nequen, the mountain slopes further north being desert, practically rainless. I hear that these alpine forests are very extensive, but at present inaccessible. They should be of importance for paper pulp some day.

All of central Argentine, and Uruguay, are open prairies. These are the regions most populated and with best transportation facilities. About the only indigenous tree, except small willows along the stream courses, is the "ombú," *Phytolacca dioica*, which is famed in gaucho

song and verse as the shade tree and landmark of the plains. It is planted a good deal in the parks of Buenos Aires, and makes a fine round-topped spreading shade tree, with very dense foliage. The wood is spongy and valueless, the roots are said to be cathartic. Exotics I will mention in later paragraphs.

The subtropical region is confined to the northeast corner of Argentine, in Corrientes and Misiones, and in Paraguay east of the Rio Paraguay. It is a densely forested rolling region, not much exploited. The best known tree is cedro or Spanish cedar (*Cedrela* spp.), which is the principal furniture wood of Argentine, and is exported both in the log (usually square hewn) or in thick planks. Most of it comes from Paraguay. There are many very beautiful cabinet woods in Misiones, which are not much known. This region has a little of the Brazilian pine, *Aracauria braziliiana*, and is the seat of the very important Paraguay tea business, which is made from the leaves of a small tree or large bush, *Ilex Paraguayensis*.

THE CHACO

The Chaco, which at present is by far the most important timber region, occupies north central Argentina, west of the Rio Parana, in the northern part of the Province of Santa Fe, the eastern part of the Province of Santiago del Estero, and all of the Territories of Chaco and Formosa, and also all of Paraguay west of the Paraguay River. The area is over 200,000 square miles, and is for the most part forested, though the forests are not continuous, being interspersed with large and small belts of prairie. Nearly all the Chaco is swampy, and all of it is practically flat. The forests are low and scrubby, with extremely dense understory of thorns, cactus, various spiny bushes, etc. At least half of the region has never been explored, and half or more of the area of land (of the portion in Argentine) still is Government owned.

Generally speaking, the forests of the Chaco are overmature and defective. There is relatively little reproduction, and the forest area is shrinking. Prairie fires are annual, and each fire enlarges the open area at the expense of the forest. In the forests the fires do not burn much. At the edges of each body of timber will be found scattered trees in the open prairie, and old fire-blackened logs and stumps.

The composition of the forests varies, both from south to north and from east to west. In Santa Fe, the portion first exploited, Santa Fe type red quebracho (*Schinopsis lorentzii*) prevails, with white quebracho (*Aspidisperma quebracho blanco*) second, and a scattering of *Chorisia insignis*, called locally *p̄alo borracho* or *sannuhi*, *algarroba* (prosopis of several species), *jacarandá* (*Jacaranda chelonina*), and a few other trees, besides (in the swampiest sites) various palms, of which the black palm (*Trithrinax*) is the most useful species.

Further west the Santa Fe type quebracho is gradually replaced by the Santiago type (*Schinopsis balansae*), white quebracho and *jacarandá* become relatively more abundant, and the palms disappear.

Proceeding northward into Formosa, the palms become more abundant, and other species appear, notably "palo santa" (*Bulnesia Sarmienti*), a tree with very aromatic dark brown wood, which sometimes grows in pure stands.

In the Paraguayan Chaco the forests are very mixed, quebracho no longer predominating. There are vast "palmeras"—open plains dotted with tall palms—and the trees in the forests become taller. There is a great deal of *lapacho* (*Tabebuia flavescens*), whose bole resembles a chestnut in shape and color of bark, and whose wood is hard, yellowish brown, fairly clear grained, and fit for sawing for lumber.

FOREST UTILIZATION

While the forests have of course been exploited on a small scale for centuries, it is only within the past two generations that any large scale utilization has been attempted. This modern exploitation may be divided into the following classes: rare cabinet woods for exportation, local construction including lumber, ties, telephone poles, paving blocks, bridge timbers, etc., fuel and by-products including tannins, dyes, paper pulp, etc.

Of the cabinet woods, only *cedro* has been exported on any large scale. One furniture factory in Buenos Aires, run in connection with a large department store, uses nearly twenty kinds of local woods, and turns out a product that compares favorably with the best American product. So far as I know, no veneer mills are located in the country, and there should be a lucrative field. *Cedro* is used in large quantities for woodwork, doors, stairs, etc.

Nearly every species is used in one way or another for local construction. Probably more white quebracho is sawed into lumber than

any other species, being used for framing, dock flooring, etc. Algarroba is used for window framing, etc. All the sawmills are very small, inefficient and wasteful, and the sawn product is of poor grade. The wholesale lumber dealers in Buenos Aires carry stocks of Brazilian pine in the rough, and limited amounts of American yellow pine flooring, dressed boards, etc., at very high prices. I should imagine the per capita consumption of *lumber* in Argentine would only be a few per cent of what it is in United States, for practically all houses are brick or adobe, floors are usually tile, and sheds, etc., galvanized iron. Wooden shingles are unknown.

Cross ties are nearly all sawn red quebracho, and last 40 to 50 years. Screw spikes are used. Paving blocks, both of quebracho and algarroba, are used in large quantities in Buenos Aires. Bridge timbers and other dimension stuff is usually red quebracho, though other species are used locally.

The best and most lasting telephone poles and fenceposts are red quebracho. The latter are shipped from Chaco to Buenos Aires in immense quantities. Locally, in northern Argentine and in Paraguay, the black palm is used for poles, fenceposts, etc., and is also split, the centers gouged out, and laid alternately concave and convex to form roofs and walls of houses and barns. In Paraguay I have seen palm poles in the round used for bridge flooring.

FUEL

Wood is *the* fuel of Argentine. There are no coal mines, and only one small oil field, which so far has not proved very productive. More coal was imported before the war than now. For instance, prior to the war, the Buenos Aires power plants burned coal, now they burn wood. All cooking is done with wood or charcoal, locomotives (except some oil burners in suburban service around Buenos Aires), the majority of the river boats, and nearly all factories of the country, burn wood. Most of it comes from the Chaco, and red quebracho predominates. White quebracho is used largely for charcoal. In the spring of 1920 coal in Buenos Aires cost \$40 per ton, household or best grade firewood \$25, railway or second class firewood \$20, and charcoal \$35. (The unit of measure for fuel is always the metric ton of 2,204 pounds.) The red quebracho fuel is largely tops and limbs remaining after logging for tannin factories, this type of fuel containing both heart and sapwood, called "green" or "railway" type, and "campana"

type, which is all redwood, very hard and dry, cut from dead and down trees, etc. This latter type is more valuable than the "green." Of course, many other species of trees are used locally for fuel.

BY-PRODUCTS

The only wood yielding a dye that is at present exploited is algarroba. There is one small factory at Santa Fe which makes a dye called "algarrobin," a dark brown gummy substance exported to Europe in wooden boxes, and said to be used for dyeing silks black. There are very probably other species that could be used for dye making.

Paper making is in its infancy. A small factory at Barranqueras, Territory of Chaco, has recently been built to make paper from the fibers of a very abundant dwarf cactus called "caraguatay," and experiments have been made with the fibers of a very abundant shrub, a species of hibiscus.

Many species of Argentine trees yield medicinal substances, but none are exploited systematically. There is a tree in Paraguay called "paratodo," whose bark is used in place of quinine, and is said to be equally efficacious.

TANNIN

By all odds the most important forest industry of Argentine and Paraguay is the making of tannin from red quebracho. Formerly logs were exported by the thousands of tons to factories in Europe and United States, but this exportation has dwindled as more factories have been located in the country. The first extract works was built at Puerto Casado, northern Paraguay, in 1889, and now there are twenty-six in Paraguay, one in Formosa, seven in the Territory of Chaco, and six in Santa Fe. Their combined productive capacity is around 200,000 tons of solid extract (65 per cent pure tannin) per year, which requires four times that amount of logs.

Only the heartwood is used, and the minimum size material used is about four inches diameter by six feet long. Most of the plants can accommodate in their chipper sheds logs up to twenty feet long and two feet or more in diameter. The trees are felled by axes, all the bark and the one-to-three-inch layer of whitish sapwood hewn off, and the logs hauled to the nearest railway or river landing in very heavy two or four wheeled wagons, with a capacity of two to three tons, drawn by two or more yoke of oxen.

At the factories, the wood is either used immediately, or piled in storage yards—preferably the former, for the wood is hard enough to cut at the best, and when seasoned out is almost like metal. Chippers, equipped with knives set on a revolving double cone-shaped wheel, like those used in chestnut extract plants, except that the openings are larger and on the side rather than on top, reduce the wood to small chips or coarse sawdust, the logs being placed in a trough and forced by a ram endwise against the knives.

The tannin is then leached out in tall copper cells, arranged in series, by a circulating stream of hot water. The "spent" or leached chips are burned for fuel. The "thin liquor" is led to storage tanks, and thence to vacuum pans, heated by steam coils, when it is boiled down to a thick sirupy liquor, and then passes to other vacuum pans with revolving internal coils of steam pipes, where it is reduced to a rosin-like substance, which is drawn off hot through an opening in the bottom into hundred-pound sacks, where on cooling it solidifies.

The finished product, at present quoted at about \$160 per metric ton, on board ship Buenos Aires, is exported to both Europe and the United States, the proportion coming to United States having increased very much since 1914.

At the present rate of use, the quebracho forests will last very many years, though the easily accessible forests are nearing their end.

Both species of red quebracho are used, though so far the Santa Fe type, being in the regions first opened up, has furnished the great majority of the wood used. It is said to be a little the best, both in tannin content and in ease of chipping. Analysis of both varieties run from 20 per cent to 30 per cent tannin.

Quebracho is also used locally in tanneries. It is sawn or ground into sawdust, and used in "layering" hides in the vats, as ground bark was formerly used in the States.

Algarroba is said to contain about 12 per cent of tannin, and is used on a small scale in making extract for tanning. Its very dark color hurts its value.

In northwestern Argentine, in the Provinces of Tucumán, Salta, and Jujuy, which may either be considered as an extension of the Chaco or a separate forest region, there is a tree called cebil (*Piptadenia cebil*), whose bark is very rich in tannin, and is used in quite large quantities in local tanneries.

There are many other tanniferous woods and plants, but none that are used on a commercial scale.

PRACTICE OF FORESTRY

This may be considered in two phases—aesthetic and commercial.

Aesthetic

This is perhaps more under the domain of landscape gardening. All the principal cities of Argentine are in the treeless portions, and planting for shade and ornament is very extensively carried on. Nearly all the street trees are exotics. Great quantities of eucalyptus have been planted, especially in La Plata and other suburb towns. It does very well, and reaches sizes up to three feet in diameter. "Paraiso" (*Melia azedarach*) is a common street tree, followed by oriental sycamore and Norway maple, with some European poplar. The only Argentine tree planted extensively for street trees is "Tupa" (*Tipuana speciosa*), a handsome tree of the Leguminosae, rather resembling a locust, but with handsome wistaria-like lavender blossoms. Other Argentine trees are used sparingly. In the parks, and especially in the wonderful Buenos Aires botanical gardens, nearly every tree in the world may be found, from blue spruces to Himalaya pine, from Japanese cherries to Brazilian rubber trees. I do not believe the Argentine gardeners, aided by the suitable climate, can be excelled in the world.

One factor to be considered in tree planting in Argentine is the danger of locusts, which periodically descend in great swarms from the northern parts, and do immense damage to crops and all growing things. I have a list, made by the ex-superintendent of parks in Buenos Aires, listing trees in their relative resistance to locust damage. The list is too long to print, but following is a selected list, ranged with the most susceptible species at the top. It will be noted that *Melia azedarach* is about the most resistant:

<i>Very susceptible</i>	<i>Susceptible</i>	<i>Resistant</i>	<i>Very resistant</i>
Acer	Acacia	Abies	Arancaria
Ailanthus	Celtis	Vetula	Gymnocladus
Calicanthus	Aesculus	Benzoin	Ionidambar
Cercis	Alnus	Cedrus	Melia azedarach
Citrus	Carpinus	Eucalyptus	Persea
Evonymus	Catalpa	Ficus	Sappora
Fraxinus	Corylus	Ilex	Taxodium
Gleditschia	Crataegus	Lyriodendron	Yucca
Hibiscus	Diospyrus	Magnolia	Zanthoxylum
Morus	Platanus	Pinus	
Phoenix	Rhus	Rhamnus	
Populus	Robinia	Viburnum	
Quercus			
Rosaceae			
Salix			
Sambucus			
Tilia			
Ulmus			

Commercial

Windbreaks are planted on a very large scale on the treeless plains, *Melia azedarach* being used most exclusively. *Eucalyptus* is used similarly.

In the "delta" country just north of Buenos Aires, where the Uruguay and Parana rivers unite to form the Rio Plata, there is a great series of low marshy islands, with innumerable interlacing canals, where willow and lombardy poplar are grown commercially for firewood, charcoal, posts, etc. I did not have time to visit the plantations, but understand they are managed very scientifically, and yield large profits.

The Argentine government spends a good deal of time talking about forestry, and periodically appoints a commission to study the situation and report, but so far nothing has been done. The land owned by the Government, including millions of acres of timberland, is not being sold at present except on a small scale and in small bodies to colonizers, and this withholding may be the forerunner of a future establishment of forest reserves. The trouble is that the timbered country is so wild and inaccessible, forest fires are so universally prevalent, and the forests generally in such a decadent condition, that I doubt if the practice of forestry would at present be feasible. Except for the swampy portions, the Chaco country is suited for agriculture, and the Government's chief aim at present is to get the country populated. Chronologically, Argentine is where United States was two or three generations ago, when the forests seemed inexhaustible, and the cry was for settlers. I doubt very much if any progress will be made until the forests seem to be in danger of exhaustion, at which time it will probably be too late.

ALINEMENT VOLUME TABLES

HERMANN KRAUCH,

Forest Examiner, U. S. Forest Service

In a recent number of the JOURNAL¹ there appeared an article entitled "Alinement Charts in Forest Mensuration." A footnote by the editor states: "They (the charts) overcome the chief objection to tables, namely, the strain on the eye after a few hours' use."

Last winter the writer constructed a series of alinement volume charts to be used in connection with the compilation of growth data obtained from a number of sample plots. The elimination of eye strain was one of the considerations that prompted their compilation, and it therefore struck a sympathetic chord to find that the objection to numerical tables is experienced by others. However, a still more efficient purpose was conceived in the construction of the alinement charts, as the following discussion will reveal.

The regular volume tables² are constructed on the basis of even-inch diameter classes and 10-inch height classes. In the compilation of periodic-growth data, it is essential to consider volumes based on the actual field measurements obtained. At least, this should be the case in order to be consistent and scientifically exact.³

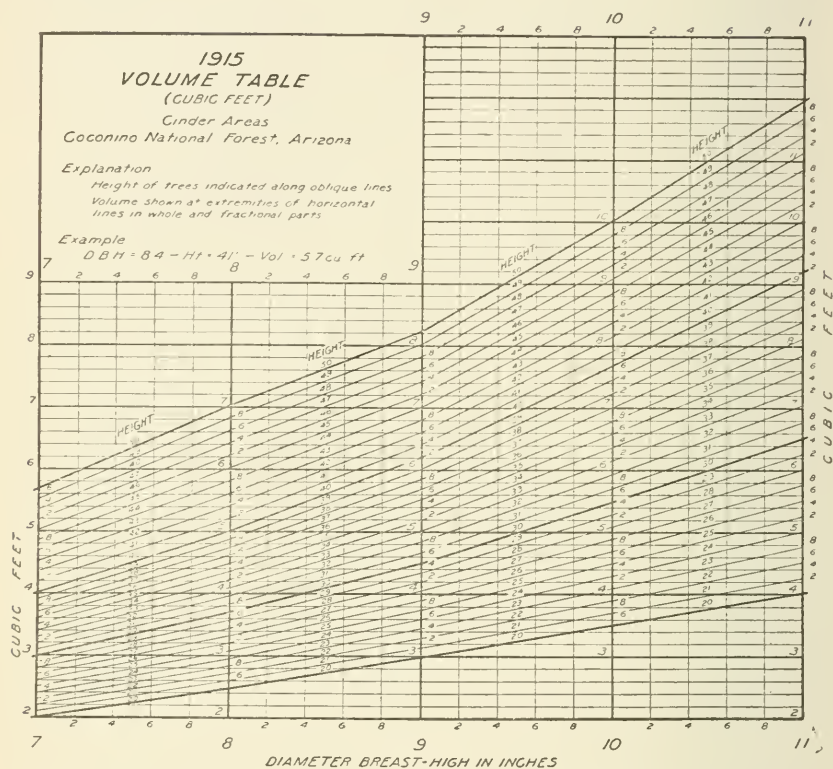
To compute the corresponding volumes from the regular tables would involve mathematical interpolation for values of each tree concerned. Since these amount to several thousands, it is obvious that considerable calculation is necessary. In order to obviate such computation a series of alinement volume charts were constructed, of which a small sample is shown in the accompanying figure. They were made by plotting the table values on standard profile plate, 1 by 30", and dividing them into fractional diameter and one-foot height classes.

The encircled figures denote d.b.h. classes; height classes are indicated along the corresponding oblique lines; while volumes are shown at the extremities of the horizontal (volume value) lines. For ex-

¹ Alinement Charts in Forest Mensuration, by Donald Bruce, JOURNAL OF FORESTRY, No. 7, Vol. XVII, November, 1919.

² Volume Tables, Yellow Pine (*Pinus ponderosa*), Coconino and Tusayan National Forests, Arizona.

ample: D. b. h. = 10.3" — height = 44' — then volume = 9.1 cubic feet (cinder area).



Not only do these charts make possible more rapid transcription of volume data, but there is less chance for error than where mathematical interpolation from the regular tables is made. Also, as noted in the first part of this article, considerable eye strain and consequent danger of error are eliminated.

³The periodic measurements of trees on sample plots involve the exact increase in diameter and height. Diameters are measured with a tape and heights with a hypsometer. Since all trees are tagged it is possible to determine the exact periodic increase in volume for each one.

SECOND REMEASUREMENT OF PERMANENT SAMPLE PLOTS OF DOUGLAS FIR ON THE WEST SLOPE OF THE CASCADES IN OREGON

BY T. T. MUNGER

In April, 1910, three one-acre sample plots were established in a 54-year-old stand of Douglas fir on the Cascade National Forest south of the middle fork of the Willamette River near Blakleyville, Oregon.

On June 3 and 4, 1920, Robert H. Weidman and Thornton T. Munger re-examined and remeasured these plots. It was then five years and six days since the former examination and ten years since the initiation of the plots. This report treats of the history and growth of these plots from 1915 to 1920. The stand is now 64 years old.

Some of the more interesting facts to be deduced from the present examination, by comparison with previous examinations, are set forth below:

1. *Number of living Douglass firs per acre over 4 inches d. b. h.*

	1910	1915	1920
Plot 1	188	175	149
Plot 2	214	198	161
Plot 3	186	172	154
Average	196	182	155

The average diameter of the trees lost in the first half decade is 6.55 inches and in the second half decade 8.90 inches. This shows that the loss has been greater in the last half decade than the preceding in number and especially in volume. It is partly due to the extra loss by snow and wind two years ago. The struggle for light is however very keen and the loss from suppression is very great. This indicates the silvicultural desirability of thinnings at this time.

2. *Number of living hardwoods per acre*

	1910	1915	1920
Plot 1	29	14	10
Plot 2	8	5	4
Plot 3	18	8	7
Average	18	9	7

The hardwoods have been practically suppressed out of the stand and are silviculturally inconsequential.

3. *Diameter of average Douglas fir tree (inches)*

	1910	1915	1920
Plot 1	13.30	14.29	16.00
Plot 2	13.51	14.60	16.20
Plot 3	14.27	15.62	16.70
Average	13.69	14.84	16.30

The diameter growth of the surviving trees during the last five-year period has been slightly greater than in the preceding period; that is, the diameter growth of the average tree was 1.15 inches from 1910 to 1915 and 1.46 inches from 1915 to 1920.

4. *Total basal area of living Douglas firs (square feet)*

	1910	1915	1920
Plot 1	180.601	195.568	207.260
Plot 2	212.260	229.740	230.910
Plot 3	207.455	229.195	234.820
Average	200.100	218.170	224.330

This table shows an increase in the gross basal area of the living trees in spite of the loss of so many trees by death, but the rate of increase is very much less in the last half decade than in the preceding.

5. *Extraordinary loss from wind and snow damage, 1915-1920*

	No. of trees	Cu. ft. vol.	Bd. ft. vol.
Plot 1	4	123.10	266.0
Plot 2	9	293.20	1056.0
Plot 3	4	137.00	435.0
Average	5 2/3	184.43	585.7

Of all the loss by volume in the last five-year period, 42 per cent of the total was due to extraordinary windfall and snow breakage and 58 to suppression.

6. *Ratio of several crown classes on average acre (percentages)*

	Dominant	Intermediate	Suppressed
1910	25	57	18
1915	17	55	28
1920	18	56	26

As stated above, differentiation of crown classes is not positive due to the element of personal judgment, but if this table is taken at its face value it indicates an increased number of suppressed trees and consequent increased crowding. This is borne out by the greater loss of trees by suppression and the lessened growth in the last half decade.

7. *Total volume per average acre (board feet)*

	1910	1915	1920	1910	1915	1920
Average of all three plots.....	37,461	43,757	47,899	8,870	9,812	10,216

Thus this 64-year-old stand contains (on the basis of close utilization and no discount for defect and breakage in logging) close to 50,000 board feet per acre, or over 10,000 cubic feet per acre.

8. *Annual growth of firs now living*

<i>Cubic feet</i>			<i>Board feet</i>	
	1910-1915	1915-1920	1910-1915	1915-1920
Plot 1	163.06	131.46	1123.2	1138.0
Plot 2	183.36	38.96	1191.2	602.0
Plot 3	218.90	72.11	1463.3	745.0
Average	188.44	80.84	1259.2	828.0

The above shows that the current increment has fallen off both in cubic feet and in board feet on all plots except Plot 1, where the board-foot growth is larger the last half decade than before. This is partly due to the extraordinary loss shown in No. 5 above. Assuming that these windfalls were still standing and alive, the increment during the period 1915-1920 would have been as follows:

	<i>Cubic feet</i>	<i>Board feet</i>
Plot 1	156.08	1191.0
Plot 2	97.60	813.0
Plot 3	99.51	832.0
Average	117.73	945.0

This windfall loss does not account for all the decrease in increment. It may be normal for a stand of this age when the struggle for existence is so keen and the loss from suppression has been so great. Mr. Hanzlik's normal volume table for Site I Douglas fir plots shows a slump in growth at about this period. It can hardly be attributed to unfavorable climatic factors for the weather records show at a nearby station a greater precipitation for 1915 to 1920 than in the preceding five years. It is noticeable that the board-foot growth, but not the cubic-foot growth (which includes the small trees many of which are dying off), on Plot 1 is greater than in the first half decade. This is the lightest stocked plot and No. 3 above shows that the trees on this plot have made the most rapid growth. This would support the contention that the falling off in both cubic-foot and board-foot growth

is due partly to retardation from overcrowding which is more intense than in 1910.

Including the trees lost by wind and snow damage shown in No. 5 above, following is the data for trees killed by both suppression (58 per cent) and by extraordinary loss (42 per cent) :

9. *Volume of trees lost by suppression and otherwise*

	<i>Number of trees</i>		<i>Cubic foot volume</i>	
	<i>1910-1915</i>	<i>1915-1920</i>	<i>1910-1915</i>	<i>1915-1920</i>
Plot 1	13	26	88.30	335.80
Plot 2	16	37	145.35	604.50
Plot 3	14	18	88.55	377.70
Average	14	27	107.40	439.37

It is striking that the volume of the trees lost in 1915-1920 is over four times that lost in the preceding half decade. Were the dead trees for both periods added to the increment of the living trees, the cubic volume growth for the last half decade would have been almost the same as for the preceding half decade. This table also shows the need for thinnings and indicates the material amount of wood, now lost, that might be salvaged by making thinnings every ten or twenty years.

10. *Contents of the average living Douglas fir (cubic feet)*

	<i>1910</i>	<i>1915</i>	<i>1920</i>
Plot 1	42	50	63
Plot 2	44	52	65
Plot 3	50	60	69
Average	45	54	66

While the loss by number of trees is greater during 1915-1920 than during 1910-1915, yet the increment of the average living tree is considerably greater.

THE WINDFALL PROBLEM IN THE KLAMATH REGION, OREGON

BY ROBERT H. WEIDMAN

Windfall affects our forests and becomes a serious problem chiefly in the open stands left after selection cutting. Therefore, in the Northwest, it is a problem mainly of the yellow pine forest. Our experience with it is limited by the length of time existing since the initiation of timber sales. In the Klamath region of the Crater National Forest, the first cutting in yellow pine sales began in 1909. In the eleven years since that time, three storms of more than usual violence struck this region and threw down an appreciable number of trees in the remaining stands. These storms occurred February 7, 1915; March 17, 1918; and April 2, 1920. This paper, therefore, will deal chiefly with the storm of April 2 and will consider the others only as they are related to the windfall problem in general.

The recent destructive winds occurred during a stormy period which covered the first two days of April and prevailed over most of the Northwest. The winds reached their greatest velocity on the afternoon of April 2, and it is these winds which blew down most of the timber. The direction was from the west and the winds were straight blowing, violent gusts. They were in no sense rotary or of a tornado character.

The damage from this storm was felt chiefly over a narrow strip of country about 15 miles long on the west shore of Upper Klamath Lake and Marsh. Over five and a half million board feet of timber was blown down within this area.

The percentage of loss by volume varied in spots from 10 per cent to 90 per cent. In the case of the body of virgin timber at the mouth of Cherry Creek (210 acres) the standing timber as well as the down was cruised, and the actual computations here show the loss to be 30 per cent.

It is interesting to compare with these figures those of the windfall losses of the two earlier storms. The storm of February 7, 1915, confined its damage mostly to the area of Varney Creek on the Pelican Bay Sale, and the volume of all species thrown amounted to perhaps 500,000 board feet or 9 per cent. In the case of the storm of March 17, 1918, a recent estimate places the windthrow at about 1,000,000

feet or more. Though no figure was given it is estimated that the loss in the last instance was over 10 per cent.

Thus the loss in the storm of this year was nearly four times as great as the combined losses of the two earlier storms. It might be added, for the sake of comparison, that it was about five times as great as the combined losses of the storms of 1913 and 1914 on the timber sales on the Whitman National Forest.

The magnitude of the loss, however, is not the problem which is created by these storms. The problem is, first and last, silvicultural, and it is one ultimately of the method of cutting. Is the solution to be found in lighter or heavier cutting? Is a radical change in method necessary or will but a slight modification of the present method obviate the loss? To answer these questions properly it is first necessary to know what can be learned about the meteorological aspects of severe windstorms: about their character, frequency, severity, and extent.

To have the benefit of professional knowledge and opinion regarding windstorms and specifically those of the Northwest, a conference was held with Mr. Wells, head of the U. S. Weather Bureau in Portland. Mr. Wells said that there were no records at all in the weather office on the character and the occurrence in detail of severe windstorms in this region. No special study or observation had ever been made of them. At the few points where complete weather stations are maintained, such as Portland, Baker, and Roseburg, consistent records of wind velocity and direction have been kept for a number of years; but no special observation of the unusually strong winds have been made, and at the small co-operative stations throughout the State not even anemometer records are kept. Because of this, Mr. Wells said that nothing at all was known about the periodicity of violent winds. As to tornadoes in Oregon, the Weather Bureau had no records, despite efforts to verify rumors of them which had arisen from time to time. Also it was the opinion of Mr. Wells that tornadoes do not occur in the Northwest, because the topography is too unfavorable for their formation. Moreover, tornadoes can be identified by their path through timber which is never more than a few hundred yards wide, and in which the windfalls characteristically lie in one direction on one side and in the opposite direction on the other side of the path. It might be mentioned that this placing of windfalls has never been observed in our experience. Mr. Wells believes that all

our violent winds are straight blows accompanying widespread regional storms.

On September 18, 1914, when the timber sales on the Whitman Forest lost so heavily from windthrow, the maximum velocity recorded at the Baker weather office was 42 miles per hour. Mr. Wells remarked that a wind, the velocity of which was 42 miles an hour at Baker, might have had a velocity greater or less at the point of the timber sales 50 miles away. The velocity there might have been as much as 60 miles, because topography greatly influences velocity. Forty miles is not a strong wind and as a rule it would take more nearly a 60-mile wind to blow down trees. His only observation of windthrow was at Boise, Idaho, in June, 1900, when a number of shade trees were blown down by a 55-mile wind. In this connection, it should be mentioned that trees weakened by clearance, as are our reserved trees, can not stand so much buffeting force as a shade tree—perhaps not more than a 45 or 50 mile wind.

It is interesting to note the maximum wind velocities on April 2, as recorded by the several stations in the State: Portland showed 32 miles per hour; Baker, 8 miles; Marshfield, 6 miles; and Roseburg, which lies in a depression, less than 5 miles. The North Head Station (at the mouth of the Columbia River), on the other hand, recorded a maximum of 52 miles in the forenoon and 64 miles in the afternoon.

Suitable wind records for the Klamath region are not available for correlation. In lieu of these, records for Baker which are readily available have been worked up. These cover a period of 25 years and extend from 1890 to 1914. During this time maximum wind velocities of 35 to 40 miles per hour occurred in nine years, of 40 to 45 miles in three years, and of 45 to 50 miles in three years. During ten years the maximum velocity attained was under 35 miles per hour. According to the records, these velocities endured in each case from 4 to 30 minutes.

It is interesting to speculate as to the possible relation of these Baker records to windfall in the forest. For the sake of discussion it is assumed that at least a 40-mile wind is necessary to blow down trees in a timber sale cutting. In 25 years, maximum velocities of 40 miles an hour and more were attained six times and occurred in the following years: 1892, 1896, 1897, 1900, 1902 and 1914. While this indicates no definite periodicity, it does show that one storm of this severity occurred practically every two years for the eleven years

from 1892 to 1902, and that thereafter for 12 years no such storms took place at all. In assuming any minimum severity of wind to blow down trees, as 40 miles in this instance, it should be kept in mind that it must be qualified by the effect of other conditions, such as the season of the year and the age of the cutting. If a minimum wind of 40 miles is required to throw trees in the spring when the ground is soft, it would take a stronger wind in the winter. Likewise it would take a stronger wind to blow down trees 10 years after cutting, when they had developed windfirmness, than it would in the first two or three years. In this connection, it is interesting to note that of the six storms here considered, three occurred in winter months and two of these were 49 and 50 mile winds. If these winter storms are eliminated as a cause of windthrow, the windfall storms would have occurred only in 1892, 1897, 1902, and 1914, which would indicate a minimum frequency of five years. It is further of interest to note that the Baker office recorded two storms in 1914; the least severe of these was 42 miles an hour and occurred in September, and the other was 49 miles an hour and came in January. The first caused the heaviest windfall yet experienced on the Whitman timber sales, while the other and stronger storm caused no appreciable loss.

To supplement what could be learned from Weather Bureau records an attempt was made on the ground to study the character and the frequency of the several destructive winds which have visited the Crater Forest, as reflected by evidence existing in the forest itself and obtained from old settlers. As already pointed out and as shown on the map, the effect of the storms of 1915 and 1918 was localized in single spots of comparatively small area, while that of the April, 1920, storm, was spread over a considerable stretch of country. Since no wind records are regularly kept in the Klamath region, the velocity in these several storms is not known. The winds, however, are known to have been straight-blowing and exceedingly violent; the direction of the first two was from the south, while that of this year was from the west. Evidence of the great velocity of the 1915 storm wind is the result of its tree-throwing power in February when the ground was hard and firm.

As to frequency, timber-sale cutting in this region began in 1909 and therefore has been in progress 11 years. When a storm occurred, preceding that of 1915, is not known; but since this was not within the history of the first cutting, there was an interval of at least 6 years

without a destructive storm. Since then the intervals between storms have been 2 and 3 years. Recalling the irregular occurrence of 40-mile storm winds as shown by the study of 25 years of Baker records, it is evident that these Klamath figures rest on too short a time basis to indicate anything definite.

A comparison, however, of the three storms with each other, aside from the matter of frequency, indicates something more tangible. Investigation of the comparative severity and extent of the several storms shows that the storm of April 2, 1920, was in a class strikingly distinct from the previous ones. It occurred over a comparatively extensive area; it caused enormously heavier losses and, what is most distinctive, it threw down an alarming number of trees in virgin timber, whereas the other storms threw none or an inappreciable number. This indicates that it was a storm of rarer occurrence than the others. A storm like this leaves its mark in the forest. Such wreckage of criss-crossed windfalls as was caused in the virgin forest by this storm, particularly like that near the mouth of Cherry Creek, would be readily recognizable in the forest for 25 years. A storm like this also makes a lasting impression upon local inhabitants. Inquiry of old settlers in this region usually brought the reply that this was the worst storm they had experienced since the one they had in about 1895. One settler remembered a swath of windfalls caused by that storm near Mare's Eggs Spring. Although his memory of the exact location was poor, the spot was investigated and a great number of old windfalls were observed, though of course it could not be determined whether they had been blown down in the same storm. About 60 per cent of these had fallen toward the east. It was not such a case of tangled wreckage as was caused in several places by the storm of this year. The fact that no such old wreckage was found in the virgin forest and that forest officers know of none, is strong evidence that storms which cause it, like the storm of last April, are comparatively of rare occurrence—perhaps of more than quarter-century occurrence.

That this year's storm, with its alarmingly heavy loss, may reasonably be expected not to repeat itself for a number of years is fairly certain. This is reassuring in forest management, because it means that there need be no immediate and revolutionary change of silvicultural treatment. A sporadic windfall catastrophe like this is a natural liability in forest management, as destructive earthquakes are in the lives of

people who inhabit regions subject to seismic disturbance. Cutting the forest clean by small areas or cutting it very lightly by large areas will not obviate or lessen the calamity when it comes, for in any forestal system there always will be standing trees to be blown down.

One distinctive feature in the distribution of the damage of this year's storm may be interpreted as indicating a possible local variation in treatment. On Cherry Creek and Fourmile Creek occurred in each case an exceedingly heavy volume of windfalls concentrated in a small area near their mouths, or rather at the ends of their valleys. This volume is believed to have been caused by the funneling of the wind currents which had entered the wide basins of the upper valleys and debouched through the comparatively narrow channels of the valley ends. The valleys lie east and west, and the wind was from the west. Restriction of the course of the wind by the local topography in this way, of course, greatly increases its intensity. Mr. Wells pointed this out and cited the example of the intense winds through the Columbia Gorge in the vicinity of Bonneville at times when farther up and down river there are only moderate wind velocities. If such areas—which might be considered areas of wind drainage—should be found by later experience to be regularly susceptible to winds of this nature, the natural conclusion would be to clear cut locally. While this would not lessen the damage in the case of a catastrophic storm, it would entirely obviate it in the case of the less severe storms which may occur every four or five years and which always throw down trees whose wind resistance has been weakened by the liberation of heavy selection cutting.

While this investigation into the causes and effects of windfall and the remedies for the problem on the Crater National Forest has produced some tangible facts, insofar as the unusual storm of April, 1920, is concerned, there is still much to be learned about the less destructive storms—though more menacing ones to our silvicultural practice—which apparently are apt to recur every few years. It is known from our very intensive windfall study on the Whitman Forest in 1914, from windfall history studies on old private cuttings, and from much observation of the results of five destructive wind storms in the timber-sale cuttings of the Crater and Whitman Forests, that no quality of the tree itself or its site is sufficiently strong to resist the force of these storms after the stand has been opened up by selection cutting. It has been learned that these storms blow down the trees in any

case; whether they are tall or short, big or small-crowned, spaced singly or in groups, in deep or shallow soil, on ridges, slopes, or flats. From the windfall history studies in the remaining stands of private cuttings up to 25 years old, it has been learned that although 25 per cent may ultimately be lost, the loss is concentrated in the first half dozen years after cutting and thereafter becomes less and less with the increasing windfirmness of the remaining trees, until it is almost inappreciable at the end of this period of time. The most important considerations in the final solution of the problem in our yellow-pine cutting practice, created by these apparently regular storms, are: (1) the periodicity of these storms, (2) their regional habit and extent, (3) the location of susceptible areas, (4) the minimum stand that can be left which will suffer the minimum ultimate loss.

With regard specifically to the storms of 1915 and 1918 on the Crater Forest, nothing could be ascertained about periodicity or any of the vital points above mentioned which would indicate a practicable variation in cutting to obviate future windfall loss. While this is to be regretted in any case, the importance is not so great here, because this particular locality is now practically cut out as a timber sale unit.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION

Forest All of Greece was well forested in prehistoric times, but the forest was reduced to about its present extent during the Homeric and post-Homeric periods. Most of the accessible forests near the coasts have gone, but there are still

dense virgin stands in the mountains of the interior. There are three main forest zones: (a) Evergreen hardwoods (0-800 m. elevation) with a dry subtype (0-500 m.) including such species as *Pistacia lentiscus*, *Olea Europaea*, *Juniperus Thoenica*, *Tamarix Hampeana*, *Quercus aegilops*, *Pinus pinca*; and a cooler subtype, characterized by *Quercus coccifera*, *Q. ilex*, *Arbutus unedo*, *A. andrachne*, *Myrtus communis*, *Laurus nobilis*, *Buxus sempervirens*, *Styrax officinalis*, *Celtis australis*, *Rhus cotinus*, *Ficus carica*, *Morus alba*, *M. nigra*. Common to both subtypes are: *Pinus silvestris* (in Macedonia), *P. halepensis*, *Cupressus sempervirens*, *Robinia pseudacacia*, *Alnus glutinosa*, and others. (b) Deciduous hardwoods (800-1,500 m.), characterized at lower elevations by oaks, especially *Quercus robur*, *Q. conferta*, *Q. pedunculiflora*, *Q. pubescens*, *Q. pedunculata*, *Q. sessiliflora*, *Q. cerris*; higher up chestnut (*Castanea vesca*) is common. Other common trees of this zone are: Ashes, hornbeams, walnut, aspen, sycamore, elms, horsechestnut, maples, lindens, dogwood, hazel and beech. (c) Conifers (1,500-2,000 m.) comprising *Abies cephalonica*, *Pinus laricio (corsicana)*, *P. leucodermis*, *P. peuce*, *Taxus baccata*, *Juniperus foetidissima*, *J. oxycedrus*.

Conifer forests (especially fir) occupy 55 per cent of the forest area. The stands are open, all-aged, and reproduction is seriously retarded by overgrazing. Growth is fairly rapid because of the long growing season and high mean temperatures. The total forest area, while not definitely known, owing to lack of surveys, is estimated at 1,800,000 hectares, including scrub forest, or 15 per cent of the total area of the new Greece (including territory added after Balkan wars). This is 0.38 hectares per capita. At least 6,600,000 hectares is absolute forest soil. The forests are very unevenly distributed, increasing from the South and East toward the North and West, and are most extensive

in northern Greece and in Greek Macedonia. Forest destruction still continues, due to heavy overgrazing (especially by goats), wasteful and unregulated cutting, turpentine, charcoal making and lime burning, and insect depredations.

A large proportion of the forests belongs to the State, considerable to communes and monasteries, and a smaller proportion to private individuals. The private forests receive the best treatment, the communal and monastic forests the worst, and the State forests halfway between.

The development of a forest policy began in 1836, soon after the establishment of the monarchy. Cutting of saw timber from either State or private forests may be done only on permit, which is issued after the payment of a felling tax. Grazing on private forests is also subject to tax, but is free on public forests. The public forests are guarded by 250 forest guards, with 12 technically trained foresters, and 3 inspectors, under the Forest Division of the Ministry for National Economy. This force is much too small, and is not well trained. The first forest school was established at Vytina in 1896 to train the lower personnel. A higher forest institute for training administrative officers is to be established at Athens by 1920. Various measures have been taken to encourage afforestation by communes and private individuals, and something has been accomplished.

The total annual yield of the forests of old Greece (figures for recently acquired territory not available) is estimated to be 1,720,566 cubic meters, probably in excess of the annual growth. In addition, Greece imports 126,000 cubic meters of wood (principally softwood construction material), making the per capita consumption 0.75 cubic meters. Imports came (1911) chiefly from Austria-Hungary, Roumania, Turkey, and Russia, and were exceeded in value only by grain and by coal. Exports, chiefly valonia and nutgalls for tanning, and turpentine and rosin, went mostly to Austria, Germany, Italy, and Turkey.

W. N. S.

Sklawunos, Constantine G. *Die Forstverhältnisse im heutigen Griechenland*. Forstwiss. Centralbl., 41:81-90, 173-184, 249-264. 1919.

*North American
Forests*

This article is the second of a series; in it the author describes his trip over the Moffat Road to Idle-wild in the Arapaho National Forest, with reference chiefly to forest types encountered. He gives a brief account of the local organization of the U. S. Forest Service and some of its work. The virgin forests of lodgepole pine,

pure or in mixture with alpine fir (*Abies subalpine*, he calls it) are considered in some detail. The system of management is far from intense as compared with German methods, only tie timber is logged, and regeneration is secured naturally, since lodgepole is a very prolific seeder. A few attempts have been made by the Forest Service to reforest burnt-over areas artificially, where neither lodgepole nor aspen have come in. Aspen and lodgepole usually occupy the land after a fire; the latter most frequently following Douglas fir. The seed extraction establishment on the Arapaho Forest is described. The dendroctonus bark-beetles cause very much damage in this region. Their activities, according to Hopkins, are of a primary nature; not secondary, as the author considers the activities of German bark beetles. Although no direct evidences of insect damage were encountered, the writer was struck with the damage caused by the porcupine (*Erethizon dorsatum*) in lodgepole forests, and gives a description of this animal.

J. ROESER.

von Tubeuf, C. *Schilderungen und Bilder aus nord-amerikanischen Wäldern*. Naturw. Zeitschr. Forst- und Landw., 17:153-166. Pl. 54-59. 1919.

With Scotch pine grown in an 80-year and
Pine and Beech beech in a 190-year rotation, the pine is nearly
Forests in five times as advantageous as the beech from a
Normandy purely financial point of view. This is partly
 accounted for by the fact that this rotation for
 beech is not its financial rotation while 80 years is perhaps the financial
 rotation for pine. From the silvicultural point of view, the advantage
 is certainly with the beech, which as a pure crop has many advantages
 which can not be assigned to extensive areas of pure pine.

C. R. T.

Hopkinson, A. D. *A note on the financial results of pine and beech forests in Normandy*. Trans. Roy. Scot. Arbor. Soc., 34:82-87. 1920.

A general consideration of the economic uses
Philippine Palms of all known Philippine palms, comprising 123
and Palm species in 24 genera. Keys are given to the
Products genera and species and brief descriptive notes,
 all local names, distribution, and occurrence are
 noted for each species. The group is one of very great economic im-
 portance, yielding a multitude of materials entering the internal and
 external commerce of the Philippines.

E. D. MERRILL.

Brown, William H., and Merrill, Elmer D., *Philippine palms and palm products*. Forestry Bur. Philippine Islands Bull. 18. 1919.

SILVICULTURE, PROTECTION, AND EXTENSION

Comparisons of the growth of Japanese and European larch at Brocklesby Park, England, which was set out in 1903-04, spaced 4 by 4 feet and mixed with hardwoods in the proportion of two softwoods to one hardwood. Measurements, presumably in the winter of 1919-20, show the following average girths of trees on an area which has been thinned three times: Japanese larch, 1.4 inches; sycamore, 11.2 inches; ash, 9.7 inches; elm, etc., 9.4 inches. On another area, twice thinned, European larch has an average girth of 13.1 inches; sycamore, 11 inches; ash, 9.6 inches; beech, 5.4 inches; and other hardwoods, 8.1 inches.

C. R. T.

Havelock, W. B. *Common and Japanese larch at Brocklesby Park*. Quart. Jour. Forest., 14:59-61. 1920.

This is a short discussion dealing with the lack of beech reproduction on the chalk Wolds of Lincolnshire, where there are many good beech woods but no natural beech regeneration. The author raises the question as to reasons for this, but does not answer it.

C. R. T.

Greenfield, W. P. *The beech in Lincolnshire*. Quart. Jour. Forest., 13:269-271. 1919.

MENSURATION, FINANCE, AND MANAGEMENT

Yearly diameter measurements of sample areas in several tracts of beech woodland situated in South Oxfordshire, England, and actual volume measurements of trees felled in these woods, disclose some interesting variations in volume related to the density of the crop. In dense woods, due to increased height growth, the average cubic contents of trees of equal diameters is higher than in woods where the trees are widely spaced. The mean annual increment for a 7-year period for seven pieces of woodland varied from 1.81 per cent to 5.4 per cent and averaged 2.8 per cent. The increment of 1.81 per cent is for a woodland where the trees stood too close and that of 5.4 per cent is for one where they did not

*The
Mapledurham
Statistics*

stand close enough. The total increment per acre was not as large in either case as would have been secured through more judicious spacing. Trees 20 inches or less in circumference show a mean annual increment of 1.5 per cent as compared to 2.44 per cent for those over 20 inches in circumference. The smaller trees owe their slow growth partly to being suppressed and partly to being old stock and consequently slow growers. These figures favor the compartment system in beech woods, for under that system all the suppressed and slow-growing trees are removed and the best-growing trees are encouraged; the removal of the small trees automatically raises the percentage of growth of the larger trees.

C. R. T.

Wood, Leslie S. *The Mapledurham Statistics*. Quart. Jour. For., 14:49-59. 1920.

By making use of the fact that the form factor varies according to the form-point, which is a relation between form of crown and form of stem, certain characteristic relations of crown, form, diameter and height are expressed and the variations of these according to the site and density of the stands. The form classes are expressed as 0.55, 0.60, 0.65, 0.70 and 0.75, the last being the best form. A tree of 40 cm. diameter breast high in the 0.55 class has a crown diameter of 5.5 m., and a tree of the same diameter of stem but in the 0.70 form class has a crown diameter of only 4.3 m. Trees of the first kind need an area of 30.25 sq. m., while those of the latter require only 18.49 sq. m. In the first class there would be 33 trees per dekar (0.1 hectare) and those of the 0.70 class would stand 54 per dekar. From this study it is concluded, among other things, that it is very poor policy to cut in such a manner as to open the stand sufficiently to lower the form class.

J. A. LARSEN.

Haslund, Ole. *Granens Stammeform*. Tidsskr. Skogbruk, 28:44-53. Fig. 4. 1920.

Due to heavy cutting in the State forests, and especially in young stands, during the war, certain changes in management are necessary. Most important is to shorten the rotation period. An average rotation of 100 years is set for pine and, in general, also for spruce. Since it will be necessary to produce high-grade large timber, common timber, and mine timber and pulpwood,

*Management
Changes in
Prussian Forests*

the stands will be managed on three different rotations, depending on the particular stands in each case, of 120 years, 100 years, and 60 years, in about the proportion 2:3:1 (making the average 100). For hardwoods the former rotations will generally be used. In case of the younger stands, decision as to the rotation to be used can be deferred until they are older. As a basis for planning the regulation, an age-class survey and map must be made. For this purpose the forests are to be classified in four main types, according to the predominating species: oak; beech-ash-maple; birch-alder; and fir-spruce-pine. Other instructions relate to changes in the working plan and cutting budget.

W. N. S.

Anonymous. *Ergänzende Anweisung zur "Anweisung zur Ausführung der Betriebsregelungen in den Preussischen Staatsforsten vom 17 März, 1912," bis 12 März, 1919.* Forstwiss. Centralbl. 41:310-317. 1919.

STATISTICS AND HISTORY

Forests and Human Progress

The author recognizes three stages in the development of man's relation to the earth's forested areas from pre-historic times until the present. These stages are designated: (1) *Civilization dominated by forests*, (2) *civilization overcoming the forests*, and (3) *civilization dominating forests*. While forming a natural sequence, it is pointed out that the stages made unequal progress in different parts of the earth. For illustration: Central Africa and South America are now in the first stage; a considerable part of North America and Asia in the second, but in Europe and parts of the United States the third stage is reached. The first stage deals with prehistoric and early historic man. It is traced through indirect means; as the migration of races, the configuration of ancient forests, and from folk lore, myth, and the vestiges of primitive religions. The second stage denotes man's progress in the production and use of tools of an advanced and efficient type and shows an increasing pressure for tillable land. This stage lies for the most part within the historic period, although place names in certain parts of Europe are excellent indirect evidence of the progress of early clearings and forest settlements. The third stage shows civilization triumphant over its ancient enemy and brings the story down to modern times. It deals with current movements and the immediate past.

In the first stage the forest exerted a profound influence upon man, both materially and spiritually, while in later stages this process was, to a certain extent, reversed. The soul of primitive man was deeply impressed by the mysterious appearance and fancied attributes of the forest and he gave them expression in primitive religions and early myth. "The Realization of Life," by Tagore, makes to live, for the present day, the role which the ancient Indian forests have played in the development of Indian civilization and philosophy. But while these effects were profound and still move mankind, it was as a barrier to primitive man's efforts that the forest stands forth as a powerful factor in the developing civilization. As the earlier phases of progress must be passed where the resistances offered by natural conditions were least, therefore the first large human societies arose and the primary stages of social development were reached in arid and treeless climates. A study of the occurrence of settlements from the earliest Stone Age shows that the cradle of civilization was not a primeval forest. The seats, or nuclei, of the earliest recorded civilizations in both the Old and New Worlds originated in arid regions with scanty forest. The Egyptian, Babylonian, Assyrian, and Phœnician civilizations arose in hot, dry regions of the Orient, while the Occident points to the Aztecs and Incas as exemplifying the highest stages of primitive civilization in the Western Hemisphere. Later advances in the arts permitted these communities to develop in more difficult regions. Thus early man was a slave to his environment and it is only through the knowledge, weapons, and instrumentalities of modern times that he has to some extent become its master. Forests were, however, not alone a barrier and a hindrance to early man; they acted as the walls of a fortress in protecting weaker tribes from powerful and more aggressive ones; and were a source of both food and fuel as well as shelter.

In the third stage begins the destruction and extensive settlement of the forests. Societies have now acquired the means and the man power to clear land on a large scale. This was not made possible without a prolonged struggle, and here is noted a psychologic influence of the forest during this period which has had a far-reaching effect on the history of the globe and its settlement in the last few centuries. For may not the great colonizing capacity of the Anglo-Saxons, the Teutons, and the Russians be attributed largely to their original impenetrable forests, in the struggle with which they have developed the

persistence and unrelenting energy required for pioneer work? To such an extent has the clearing and settlement proceeded that the forest over a large part of the world is conquered. More than this, it is exterminated beyond any possible chance of natural recovery. The turn of the road has come and it is now important for civilization to preserve and restore the forest instead of struggling against it. As an example, Europe, where the greatest change has taken place, has out of a total land area of $2\frac{1}{2}$ billion acres barely 750,000 acres in forest and two-thirds of this small area is concentrated in Russia and Finland. In fact, Europe reached the point several centuries ago which practically all civilized countries of the world have now come to realize: i.e., that there is a limit beyond which clearing of forest areas can not go, no matter what the density of the population may be, without proving detrimental to progress itself. Hope is not left out of the reckoning, for it is stated that there is enough accessible actual and potential forest land, not suitable for agriculture, in civilized countries to produce under proper management timber enough to supply indefinitely the world's great demand. The new movement toward rational management of the forest is then noted and its direction and importance pointed out. The managed forests of the future will be no less an important factor in civilization from the ethical and geographical point of view because the economic principles at present applied to the raising of agricultural crops are becoming more and more necessary for the forest. The new forest may be different from the original forest, but its influence on and usefulness to mankind will remain unchanged irrespective of its economic metamorphosis.

Thus the author concludes a fascinating bit of epic prose in which the primeval forest is vitalized as a living force in its influence upon the plastic primitive races of man in their development from civilization's dawn until the present. And he brings it home, that, as the forest played so important a part in the past, modern man, in the light of present knowledge and advantages, should consciously mold this natural wealth to meet the permanent and distant needs of present and future civilizations and enable the story of the forest in later times to form an epic on even a grander scale than the influence of its past.

E. R. HODSON.

Zon, Raphael. *Forests and Human Progress*. Geogr. Review, 10:139-166, Sept., 1920.

*Wood Famine
in Vienna*

Because of unsettled political and industrial conditions no fuelwood is coming into Vienna, and hardly enough coal is received from Czechoslovakia and Poland to keep the gas and electric works going. Wood costs 1.5 kroner per kilogram (equivalent to about \$350 to \$450 per cord). Thousands of people "make their own wood" by breaking or cutting down street and park trees, and several parks, notably the Schwarzenberg, had already (January) been stripped of trees.

W. N. S.

Herpt, G. *Holznot in Wien..* Deutsch. Forstzeitg.. 35:25-26, 1920.

*Forestry and
Wood Industry
in East Prussia*

Wooded area in 1913 was 660,841 hectares, or 17.7 per cent of the land area. The forests were divided into 23,120 tracts, of which 22,942 were connected with farms; 84 per cent were under 10 hectares in size, and made up but 7.9 per cent of the total area; the 114 tracts greater than 1,000 hectares comprised 68.5 per cent of the total area. Deciduous species occupied 21.7 per cent of the area, or 143,305 hectares; two-thirds of this was high forest, divided into three types, oak, birch-alder-ash, beech and others, at about a 1—3—1 ratio. Conifers occupied 517,536 hectares (78.3 per cent), of which 96,132 hectares were selection forest and the rest high forest. Scotch pine covered 338,629 hectares, spruce 168,100 hectares, white fir 10,524 hectares, and larch 283 hectares. Pine predominates on the sandy soils of the south, spruce on the loams in the northern and central districts, oak on the best soils, while hornbeam, birch, aspen, and linden are common in mixtures with conifers on the better sites. Aspen and birch quickly occupy areas denuded of conifers. The forests suffer considerable losses from late and early frosts, storms, and insects—timber cut from the State forests (386,000 hectares in 1904, and 417,000 hectares in 1912) increased from 4.14 cubic meters per hectare in 1904 to 11.75 cubic meters in 1910, due to ravages of the Nun-moth. In 1912 but 5.01 cubic meters per hectare was cut, nearly half of it fuelwood. Yields of the larger private forests are about the same as those of State forests; the smaller private holdings are not managed as well, although steps have recently been taken to promote forestry on private holdings. Before the war, wood exports consisted chiefly of firewood and mine timbers, to western Germany, and construction material to Berlin and vicinity, and amounted in

all to about 350,000 tons per year. More than 2,200,000 cubic meters of wood were imported from Russia to supply the sawmills and pulp-mills in the Memel region. Rapid development of the sawmill industry in Russia has resulted in increased prices of raw material for the Memel mills, and at the same time to lower prices for manufactured lumber. W. N. S.

Von Mammen. *Forstwirtschaft, Holzhandel und Holzindustrie in Ostpreussen*. Forstwiss. Centralbl., 41:368-388. 1919.

POLITICS, EDUCATION, AND LEGISLATION

Restriction of Clearing in Forest

Before the war Germany was a heavy importer of wood, but now most imports have been cut off, due to the world-wide shortage of wood and to the high prices and unfavorable rate of exchange. Moreover, large areas of forests have been lost to Germany as a result of the war. The scarcity of fuel has resulted in enormous demand for firewood, which further reduces the production of building material in German forests. The same conditions that hinder imports favor exporting of wood, and a considerable illicit trade is carried on across the border. The net result of these factors is a tendency to destroy large areas of private forests for immediate profit. The central government has proposed a decree forbidding clear cutting, or cutting which leaves less than one-fourth of a normal stand, on any area of more than 0.5 hectare in other than State forests, except with permit from designated authorities. Such permit may be withheld in case the proposed cutting endangers the given stand or neighboring ones, through formation of torrents, shifting sands, or exposure to wind, or if the stand to be cut is at a period in its growth where considerable loss in volume production would result from its cutting, or if a continuous supply of wood for the local population and industries would be threatened, or if reforestation would be made difficult. A sufficient sum to carry out reforestation measures must be deposited with proper authorities. Penalties for violation are set at from 1,000 to 10,000 marks per hectare, unless local laws prescribe higher ones. W. N. S.

Anonymous. *Eine Verordnung über die Einschränkung der Kahlschläge in den nichtstaatlichen Waldungen*. Deutsch. Forstzeitg., 35:193-194. 1920.

MISCELLANEOUS

*Devastation
Around Vienna*

Although cutting of marked trees is permitted on a strip 3 kilometers deep and 50 kilometers long in the Wienerwald, no one takes the trouble to locate the marks, and all the trees are being cut. Trees planted along the banks of the Danube to prevent flood and washing have also been cut. The famous Waldgürtel (forest belt) has been almost entirely destroyed. Many people make a regular business of stealing wood and selling it; schoolboys make 100 kroner a day, and many coachmen have become very wealthy. In the Hütteldorf forest there are, on the average, 10,000 wood thieves at work on week days and 100,000 on Sundays.

W. N. S.

Anonymous. *Waldverwüstung in der Umgebung von Wien*. Deutsch Forstzeitg. 35:42. 1920.

*Salary Reform
in Germany*

A reclassification of the civil service of the Empire is proposed, under which all positions will be grouped in twelve grades. An employee of any grade shall have the opportunity to rise into a higher grade. Basic salaries are to be greatly increased, and in addition allowances given for quarters, graded according to the town where the officer is stationed (5 classes of towns). Besides, a bonus will be given to allow for the present high cost of living.

W. N. S.

Anonymous. *Zur Besoldungsreform*. Deutsch. Forstzeitb., 35:75-76. 1920.

*General Forest
Organization*

It is proposed to organize the work under the four branches: Working Plans, Exploitation, Clerical, and Educational. The functions of each branch and its organization are depicted.

E. N. MUNNS.

Bryant, H. B. *A suggested general forest organization for the Madras Presidency*. Indian Forester, 46:205-212. 1 fig. 1920.

NOTES

THE REUNION OF YALE FORESTERS

On December 21 and 22 the alumni and former students of the Yale School of Forestry will hold a reunion in New Haven in honor of the twentieth anniversary of the foundation of the school.

Although twenty years is a short period in the life of a profession, most of the progress in American forestry and nearly all the development in forestry education has been during this period. The oldest of the graduates of this school are men now in early middle life, but their professional work reaches back to the beginning of all real progress in the organization of American forests for sustained yield.

The first decade in the life of the Yale School of Forestry terminated with a reunion which brought together in New Haven a large percentage of the alumni and former students. This meeting initiated the plan of a decennial reunion. At the close of the first decade 205 men had received the professional degree of Master of Forestry and there had been a total attendance exclusive of summer-school students of approximately 300 men. The history of the first decade of the school's existence and a biographical record of the graduates and former students was published shortly after the reunion.

Another ten years have passed and the present year will witness the second gathering of Yale foresters. They will come from every State and from many foreign countries, and it is confidently expected that this reunion will mark an epoch in the history of the school.

During this second decade 185 men have received the professional degree and there has been a total attendance exclusive of summer-school students of approximately 350 men. Were it possible for all who have received instruction, including summer-school students, to participate in this forthcoming event there would be present approximately 840 men.

What have these 840 alumni and former students been doing? More than fifty are engaged in forestry education in this country and abroad. During the past twenty years approximately 250 have been the dominant force in the development of the United States Forest Service. Many have been engaged in the organization and development

of State forestry. Others are employed in private forestry. A large part of the current literature dealing with American forestry and a majority of the manuals and text books on this subject have been written by Yale men.

More than forty foreigners have received instruction and they are coming in recent years in increasing numbers. Yale foresters are today practicing their profession on every continent. The record made by them in twenty years is a commendable one and reaches not only into every nook and corner of this country, but into many other parts of the world as well.

The first reunion of Yale foresters was a notable event. The forthcoming reunion, drawing as it will upon twice as large a body of men and upon men of larger and wider experience, will make the occasion long to be remembered, an occasion not only of vast and far-reaching importance to the school, but to American forestry as well.

J. W. T.

THE MISSOULA SECTION

Elers Koch, President of the Missoula Section, and for two years forest fire expert in the district forester's office, has recently been promoted to the position of assistant district forester in the branch of Forest Management. Mr. Koch entered the Forest Service in 1903 upon graduation from the Yale Forest School, whither he went after his graduation from Montana State University. In the Forest Service he occupied the position of student assistant and forest inspector up to 1908, when he became supervisor of the Lolo National Forest, which position he held for about ten years.

G. C. Cheyne, Deputy Conservator of Forests, Burma, Malay Peninsula, was informally entertained at dinner by the local section of the Society of American Foresters, at the conclusion of a three-days' visit to the logging engineering branch of the office of the Forest Management in the district organization. Mr. Cheyne held the attention of his hosts for several hours with descriptions of very many phases of forestry work in Burma. It is noteworthy that although the settings and details may vary enormously from forestry work in this country, yet the fundamental problems in Burma, especially in administration and organization, are closely parallel to those in the Federal Forest Service of the United States.

Mr. Cheyne is a Scotchman and an Oxford graduate of 1911 who immediately thereafter began an eight-years' straight period of service in the inhospitable climatic conditions of Burma. Ordinarily he would have been granted leave every three years, but this was precluded on account of the war. For the last five years in Burma he has been specialist in extraction. "Extraction" in Burma is the name given, not to anything resembling destructive distillation of wood, or the turpentine industry, but means the harvesting of the timber crop. Thus he resembles in his function our logging engineers. It is in this capacity that he was sent to this country to study our logging methods.



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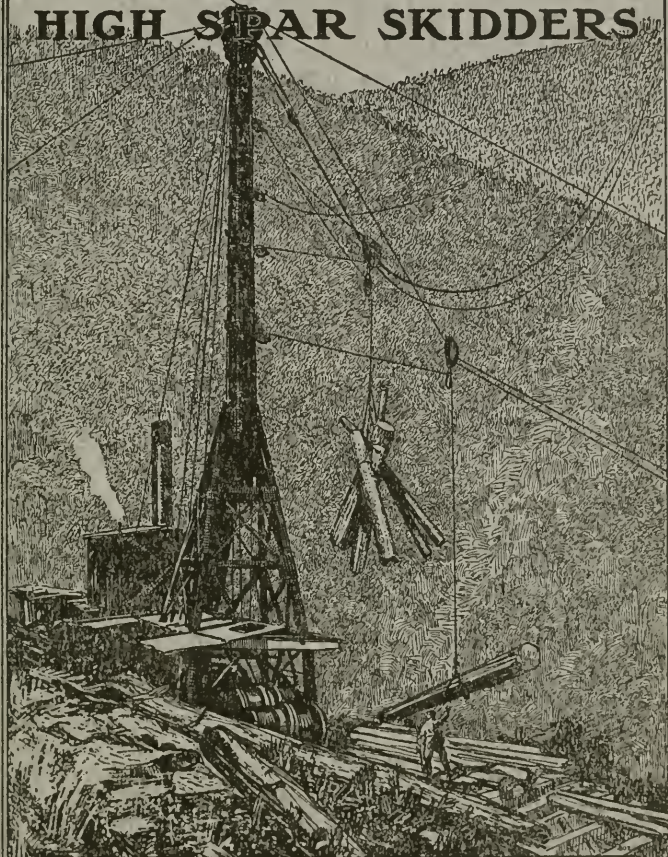
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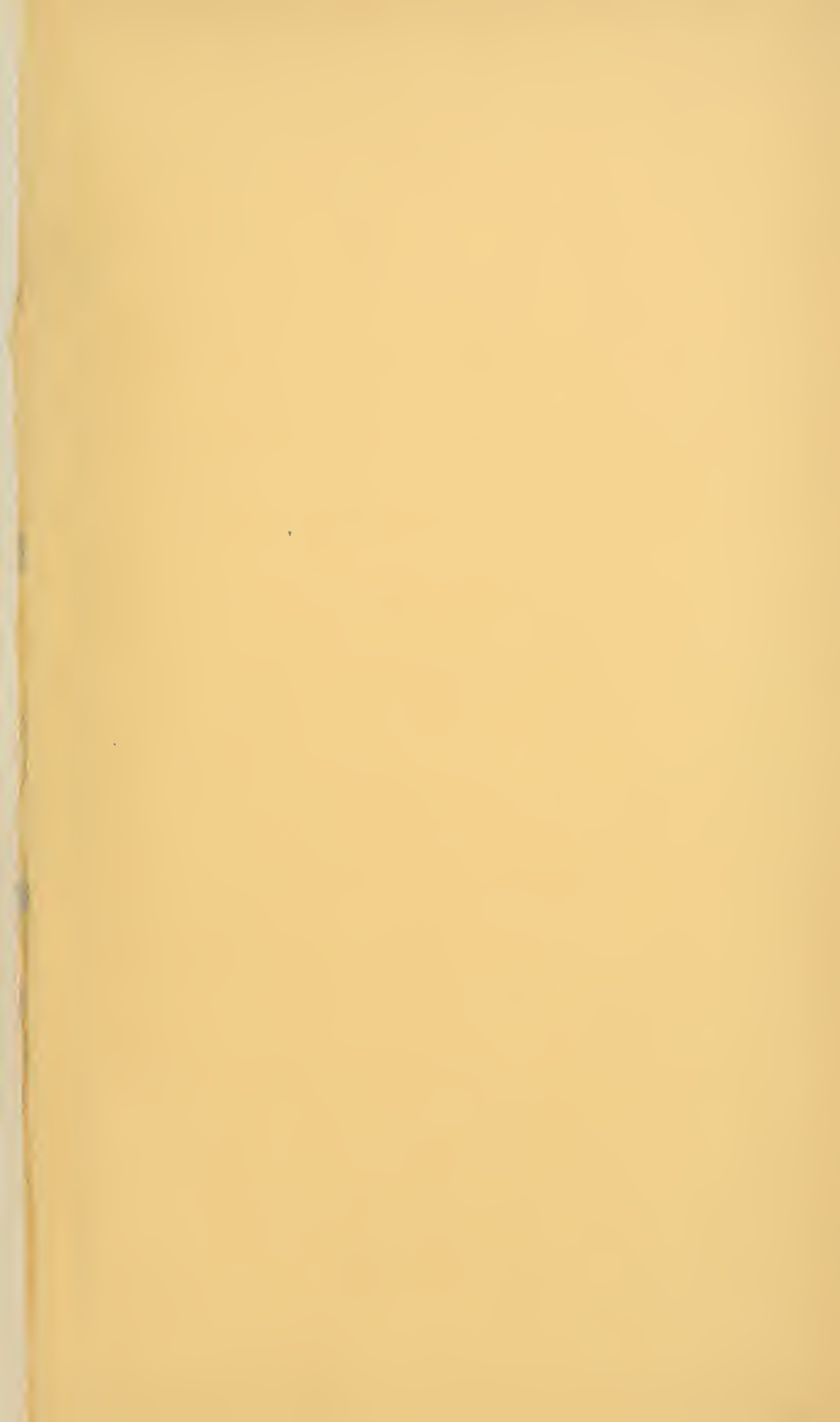
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